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MAY - 1942
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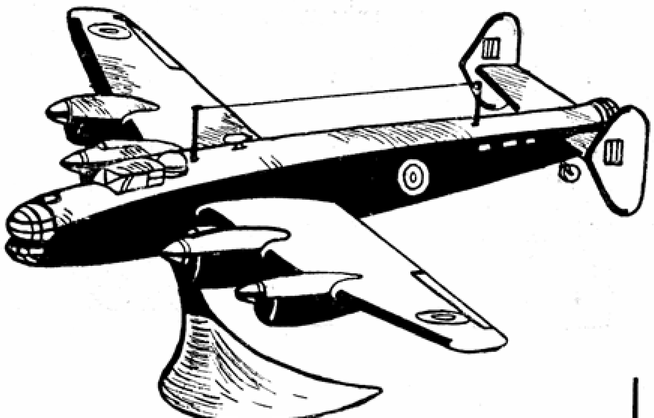

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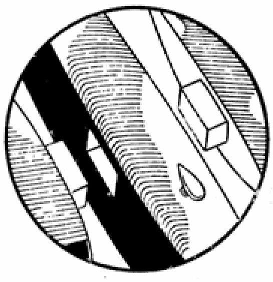

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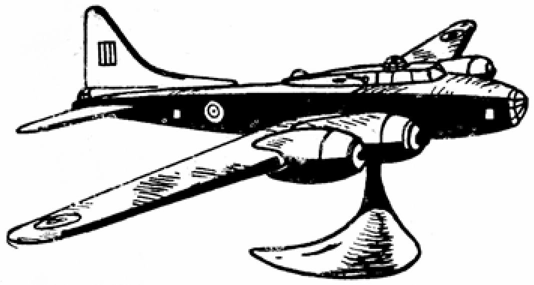

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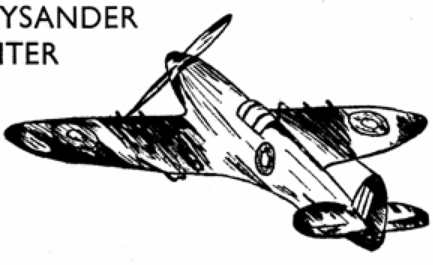

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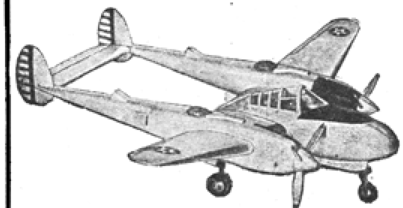

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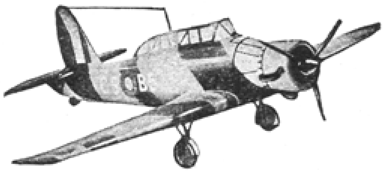

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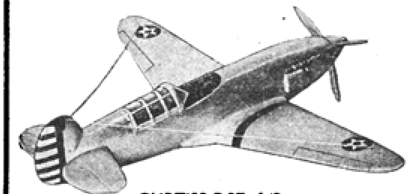

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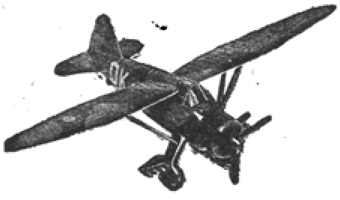

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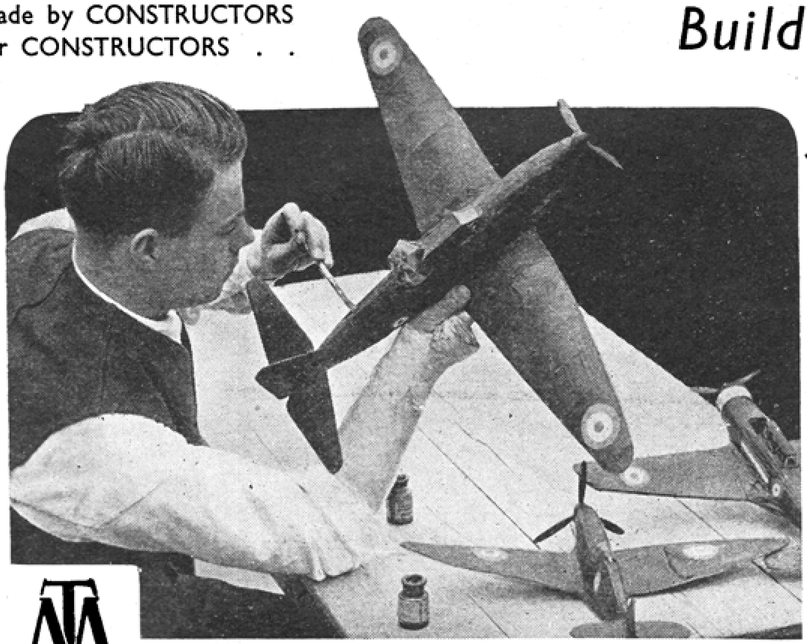

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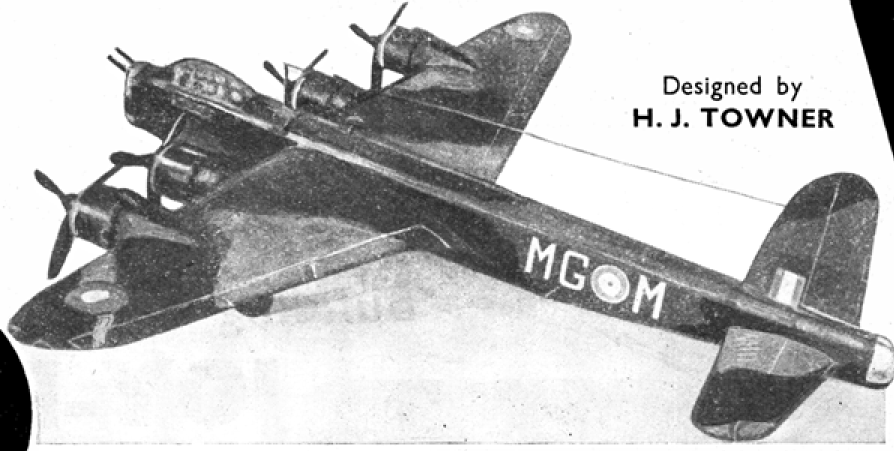

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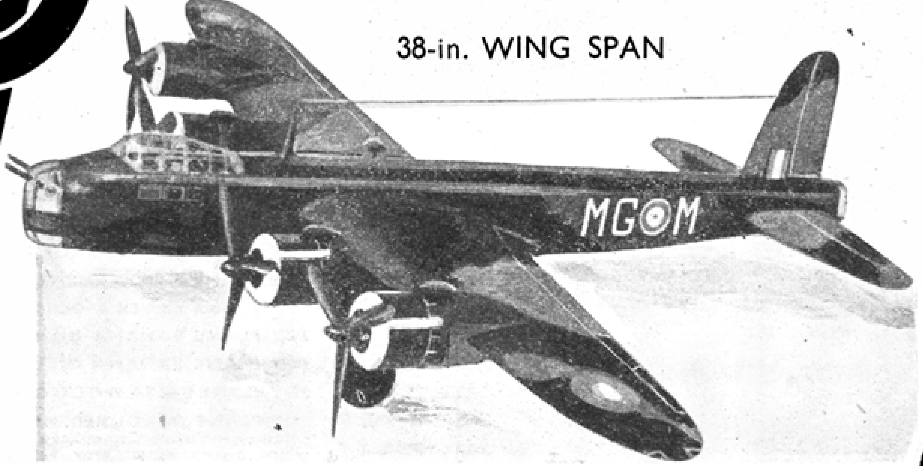

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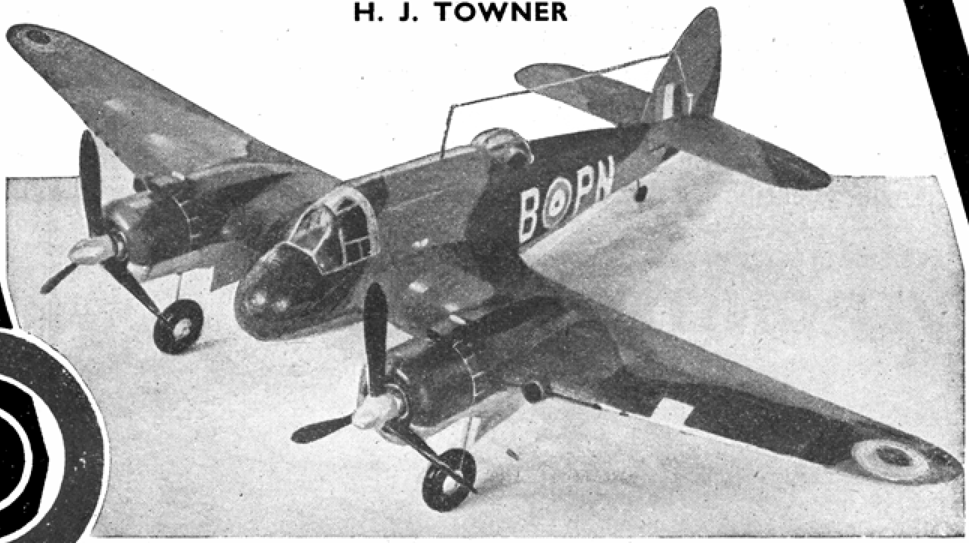

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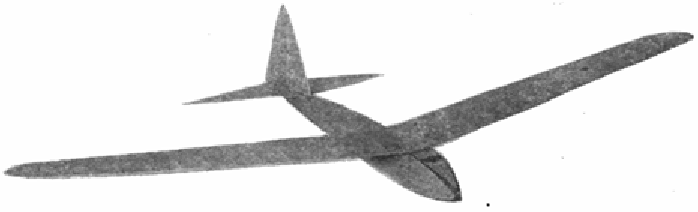

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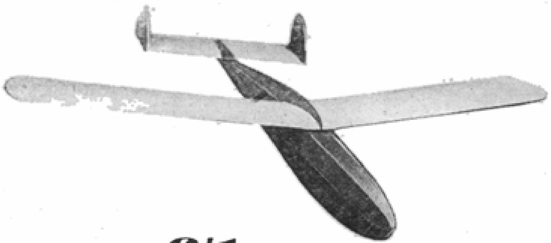

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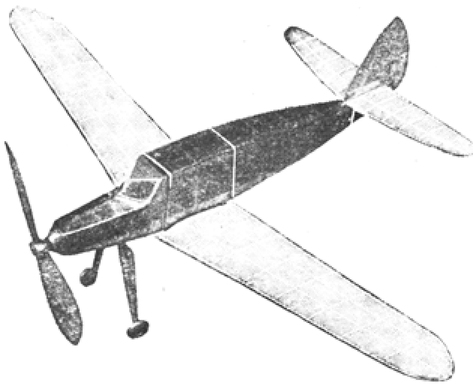

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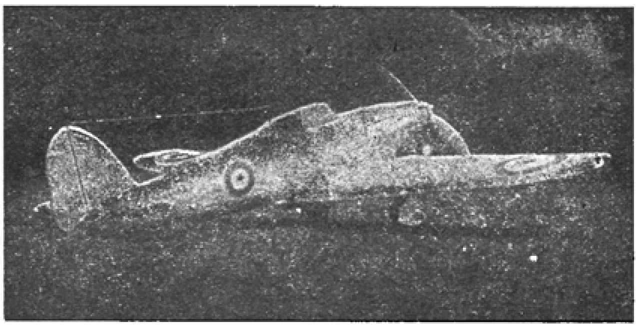

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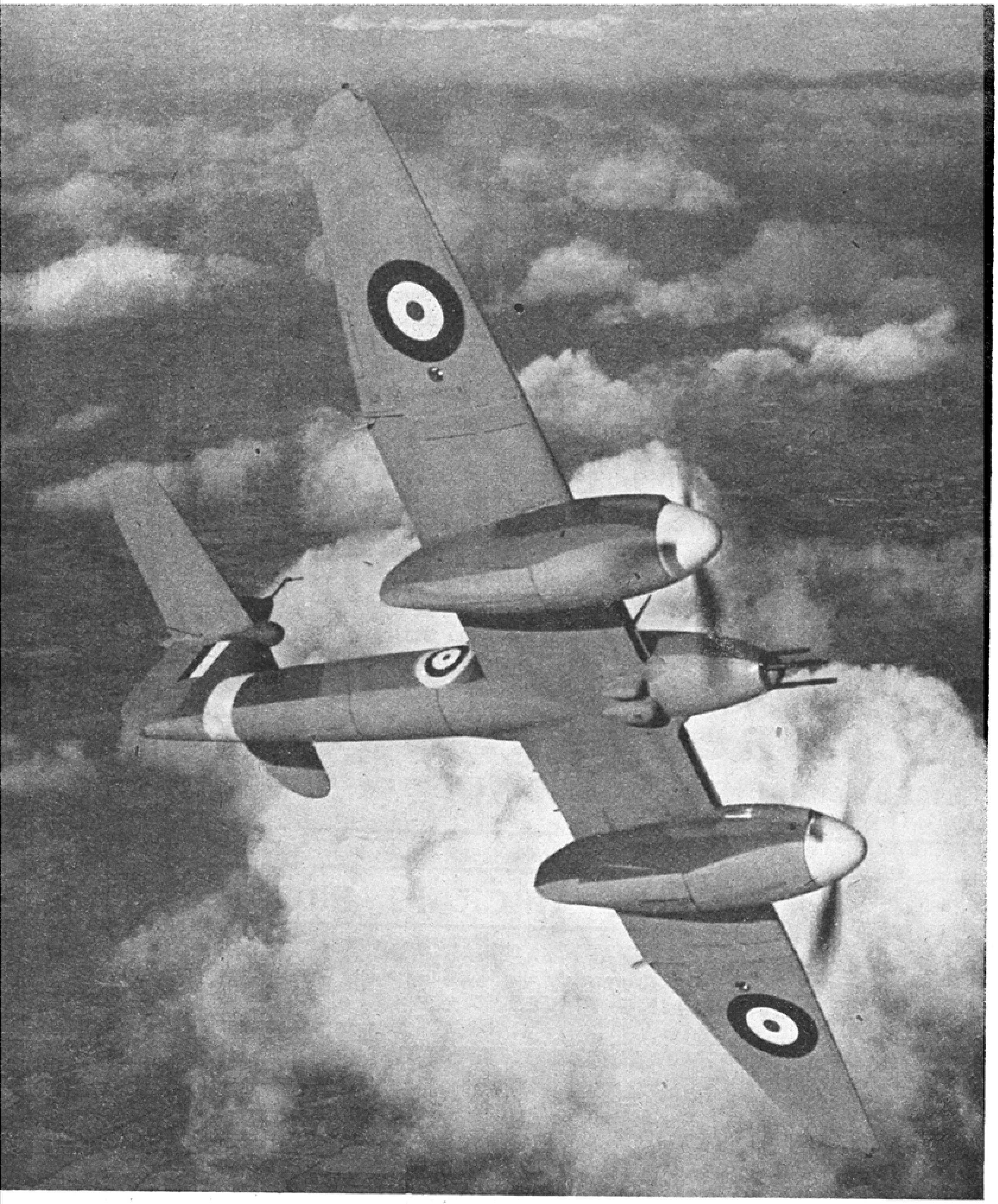

***AT LAST!* The Westland " Whirlwind," a description of which, together with $\frac{1}{72}$ scale drawings, will be published in the next issue of the Aero-modeller.**

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THE AERO MODELLER

Established in 1936

(INCORPORATING "THE MODEL AEROPLANE CONSTRUCTOR")

(Proprietors : Model Aeronautical Press, Ltd.)

THE MODEL AERONAUTICAL JOURNAL OF THE BRITISH EMPIRE

Managing Editor : D. A. Russell, A.M.I.Mech.E.

Editor : C. S. Rushbrooke

Vol. VII - No. 78 MAY, 1942

ALLEN HOUSE, NEWARKE ST., LEICESTER

EDITORIAL

WE are pleased to announce that the prize of ten guineas offered in our Paper Salvage " Drive " goes to the Eastbourne Youth Centre, Upperton Road, Eastbourne, of which Mr. H. J. Towner of scale model fame is one of the principal organisers. The weight of paper collected by the twelve members of the Club, as at January 31st, 1942, was 1 ton 9 cwts. 3 qrs. as certified by the Borough Engineer of Eastbourne.

Calling All Readers !

On behalf of our advertisers we would stress the importance of readers giving clearly their names and addresses when ordering goods. Under war-time conditions the possibility of orders occasionally going astray has somewhat increased, and from time to time we have had odd complaints from readers that they have not received goods for which they have sent cash with order. On investigation we have almost invariably found that the Model Firm in question has duly received the order and accompanying remittance, but has been unable to deal with it as the sender had omitted his address or given an incomplete one which the Post Office could not trace. We would also point out that it is essential that readers, when writing to advertisers for information, should enclose stamped addressed envelopes for their replies.

Last Month's Glider Article

We have to correct an error which occurred in R. H. Warring's glider article in our last issue. It concerns the method of calculating the angle of incidence for minimum sinking speed and the graph, diagram 4, illustrating the method shows Cl plotted against Cd whereas it should have been Cl^{1-5} plotted against Cd. The graph as it stands gives the angle of incidence for the *best gliding angle* which is *not* the same as that for minimum sinking speed, this difference being duly noted in the text. Actually this method does not appear to be generally adopted for calculating wing incidences and next month's *Technical Topics* will deal fully with a further method, suggested by L. G. Temple, which is very accurate and should, once and for all, solve that very vexed question of wing incidence.

1/72 Scale Plans

On page 222 is a full list of military aircraft in use by the warring nations of which 1/72 scale plans and photographs can be obtained. Actually these are reproductions from " Aircraft of the Fighting Powers " Volumes I and II, which, for the convenience of model builders, have been reprinted in loose-leaf form and thus may be purchased individually. Particular attention is drawn to the reduction in price which may be obtained by ordering quantities of not less than 1 dozen photographs or plans ; it should be noted that in regard to the *plans* the price is the same for all sizes.

Air Foil Sections

J. W. B. Cruickshank's " Airfoil Sections for the Aero-modeller," which was first published some two years ago, ran through a print of several thousand copies and has for some little while been unobtainable.

Recently Mr. Warring has entirely revised this book, and it is now re-issued in enlarged form at 2s. per copy or 2s. 3d. post free. Whilst the book still contains particulars of 36 Airfoil Sections, several changes have been made, and the explanatory chapters at the beginning have been entirely re-written and enlarged. The book now contains 64 pages, and is issued with a stiff card cover in colours.

Tapered Wings

In the past, some reluctance has been felt in regard to building tapered wings owing to the effort necessary to draw out correctly each of the sections exactly to scale. This can now be overcome by the use of sheets of airfoil sections as described on page 265 of this issue. Complementary to Warring's book are sheets of each of the 36 airfoil sections described in it.

Each sheet contains 31 accurate profiles, ranging from 9 in. chord to 3 in. chord by 1/5 in. steps. The sections are printed in black on thin white paper, and may be pasted direct on to balsa sheet, or thin ply for cutting out as templates. Wings of any degree of taper may be built with the aid of these sheets. In addition, each sheet has a graph which gives the chief characteristics of the section from zero lift to the stalling angle. Size of each sheet is 30 × 10 in. Price of each sheet is 6d., post free.

Every keen aero-modeller should get a copy of " Airfoil Sections for the Aero-modeller " for reference purposes ; then, when the choice of wing section has been made, the appropriate sheet or sheets can be ordered . . . and the construction of a tapered wing may be considered as painless ! !

D. A. R.

Dear Sir,

I was particularly interested in Clubman's comments on R.T.P. and Indoor flying in this month's (March) Club News, and I consider that he puts the status of R.T.P. in a nutshell when he says ". . . is proving a blessing to harassed club officials who have always had a tough time keeping the boys together during the ' off ' season."

R.T.P. flying in its present popular form is, in fact, little more than a stunt encouraged by club committees to keep their less enthusiastic members interested during the winter months. It requires a minimum of skill, and no more technical knowledge, so that it can never attract the serious modeller, except, perhaps, as a means of testing airscrews, etc.

It afforded the enthusiasts some little amusement to witness the lofty S.M.A.E. descending to fix the heights of poles. Rather like the M.C.C. going into solemn conclave over the diameter of lamp posts to be used as wickets for backyard cricket.

Indoor flying, on the other hand, is probably the most scientific branch of the hobby. There are available wind tunnel reports on indoor aerofoils (J. A. L. Series and McBride B7) ; Indoor components are built to within at least 0·001 oz.

of their designed weights; the construction is designed to be just strong enough to do the job required of it; figures for lift, drag, flying speed and other data can be obtained for each model; and so on.

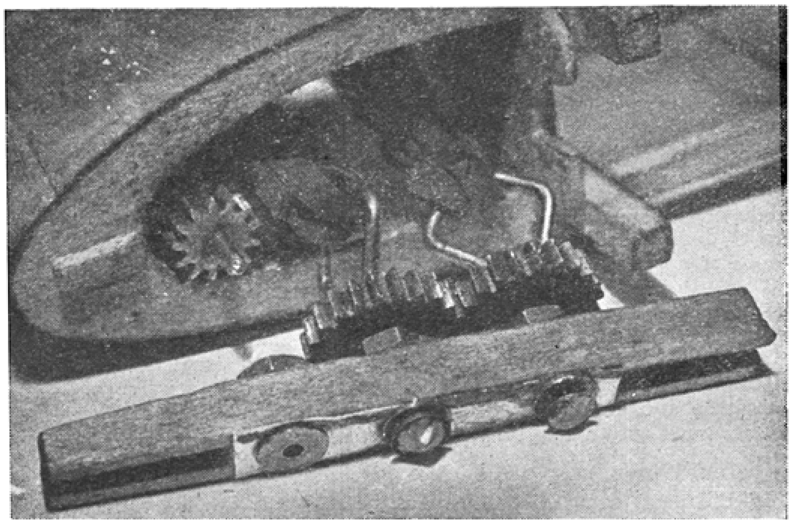
There is, however, a deep-rooted idea—supported by Clubman's remark "facilities are not available to everyone, and it is only in odd spots that good efforts can be made"—that a large hall is required for Indoor flying. This is quite wrong. It is not necessary to have an Akron Air Dock or an Albert Hall. The average clubroom will do quite well, and if a classroom, or a small hall can be used, so much the better. But—and this is the important point—it is no good trying to fly a model designed to climb to 100 ft. if the ceiling is 10 ft.

There is a vast field of research open to those enthusiasts who try Small Space Indoor Flying, and undoubtedly a new style of model will be evolved. The Glasgow boys pioneered this form of flying over two years ago, and had flights approaching the two-minute mark with an 11 ft. ceiling, but they had only begun to produce specialised designs, when facilities for flying copies of the standard American types were obtained, and Small Space Flying was neglected.

Certainly Indoor flying is no game for the happy-go-lucky. "It's simple and strong and it does the job" school, nor do Indoor models resemble full-size aircraft, but then, why should they? Man-carrying aircraft must, for practical reasons, have their efficiency impaired by thick fuselages, bulging cockpit covers, large wheels, exhaust pipes, etc., but there is no reason at all why model aircraft ("model" is misleading, but it is too late to alter it now) should copy these.

However, that is another story and I should like to conclude by inviting keen modellers to leave R.T.P. to the youngsters, and to try Small Space Indoor Flying in which, I feel sure, they will find new scope for their skill and ingenuity.

I am,
Yours faithfully,
J. H. Maxwell.



A SOLUTION to the problem of multi-engined drives for a rubber-powered model is to enclose the motors within the wings. Full details of this arrangement, as suggested by Mr. R. M. Smith, are given on the opposite page and the photograph above shows the root end gearbox. The main drawback to this scheme would appear to be the sharp 'angling' of the airscrew shaft.

NAVIGATION as applied to model flying! A group of American aero-modellers, led by Jaque Hauser, have reduced the process of finding a lost model to a few simple calculations. Apparently these fellows fly near wooded country and as one's sense of direction when wandering through a belt of trees is liable to become extremely vague they plot the probable landing place before setting out in search. The principle of their "plotting" is as follows:—a model is trimmed to fly in circles but the centre of this circle will travel downwind with the same speed as the wind. Knowing the duration of flight this fixes the distance travelled and by taking a compass bearing on the model the approximate landing place can be plotted on a map of the district. Obviously this method has many limitations but, nevertheless, is most interesting.

THE average span of a rubber-powered model of the Wakefield class is about 44 in., but in America they build petrol 'planes smaller than that. One of the smallest has a span of only 27 in.! The weight of the petrol engine for such a 'plane, minus coil, condenser and battery is sometimes as small as $1\frac{3}{4}$ oz. or just about one half the weight of a Wakefield's rubber motor!

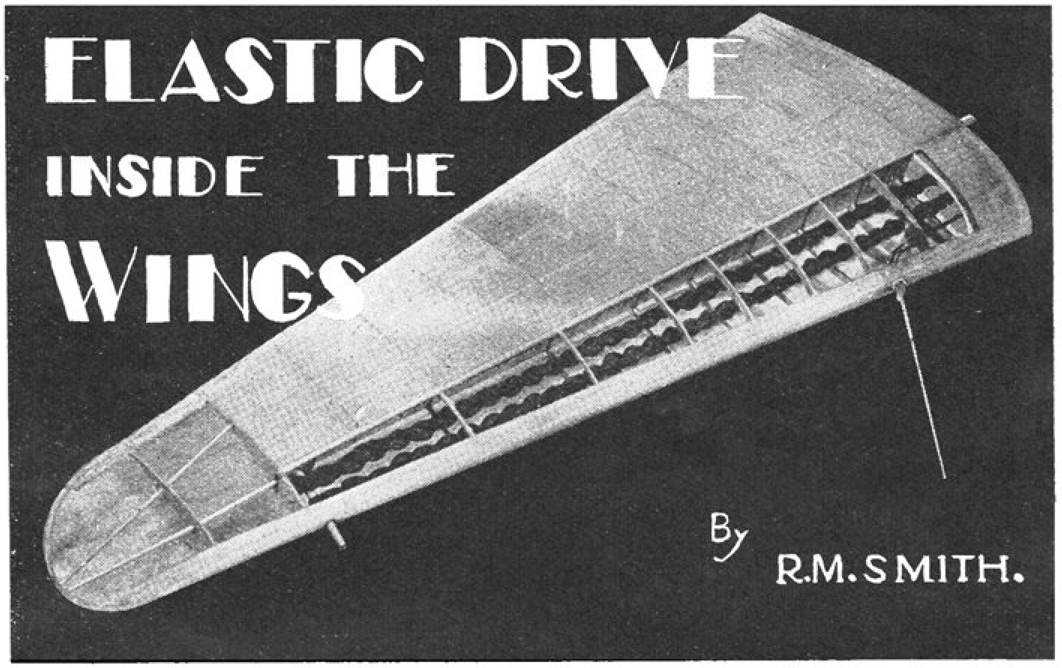
ARGENTINE also sends news of a compressed air driven model with a three-bladed airscrew which should be capable of a good performance. The compressed air fans never completely die out but, as yet, the results achieved have not been sufficiently good to warrant a large following.

UNIQUE twin-motor layout is featured in a recent American petrol model. The machine is a fairly conventional parasol design, with the exception that the wing is mounted rather more above the fuselage than usual. One motor is mounted on the front of the fuselage and the other on the trailing edge of the wing centre-section, driving a pusher airscrew. In this manner directional control is not affected should one motor cut out, but it would appear that longitudinal control is extremely tricky due to the difference between the two thrust line positions. The wing motor cutting out would probably lead to a stall or the front motor cutting out a dive. A large tailplane helps this difference in trim to a great extent, but it would seem better to endeavour to make the two thrust lines coincide.

AMERICA can usually be relied upon to supply the unorthodox, but a good many of such ideas are noteworthy for their originality rather than a serious consideration of the facts concerned. An example of this occurs in a high wing petrol model in which the wing halves are separated—in other words the "centre-section" consists of two spars only and there is a gap between the right and left wings. Actually a gap such as this seriously decreases the efficiency of a wing and must be avoided whenever possible. It is never desirable to separate the wings in this manner and even a "bite" out of the centre-section will adversely affect the wing's performance. In certain of the old military biplanes this "bite" was unavoidable if the pilot was to have any upward view at all and then, to reduce the ill-effects as much as possible, it was usually taken out of the trailing edge only.

A FAVOURITE sport in the United States is now the racing of petrol-driven model race cars which are run R.T.P.! Converted aero engines or special engines of a similar type are employed and speeds in excess of 80 m.p.h. are reported. At that speed, and on a line too, they must be near flying!

A POPULAR event at certain recent American meetings has been a balloon bursting competition. A number of pins are stuck into the leading edge of a model's wings and it is then flown amidst a string of gas-filled toy balloons. The winner is the one that brings down the greatest number of this miniature barrage.



ELASTIC DRIVE INSIDE THE WINGS

By R.M.SMITH.

Twin-Engine Layout.

The heading photograph shows the starboard wing of a model Wellington that I am building to the scale of $\frac{1}{2}$ in. equals 1 ft. The problem of providing a suitable drive for the twin motors has been met by an experimental layout in which the elastic is housed in the wings themselves between the mainspar and the leading edge.

Two skeins of $\frac{1}{4}$ in. rubber, 15 in. long are used to drive each propellor. These are secured near the wing tips by a short length of dowel pushed through the leading edge and the mainspar which can be withdrawn when required as in the conventional rear peg fixing. The peg can either be pushed in flush with the leading edge or a small length left protruding to simulate any fitting that the prototype may have at this point.

The other ends of the motors are geared together at the wing root and thus revolve in opposite directions. This eliminates any torque in the wings themselves which might otherwise distort the framework. The second photograph shows the actual root gear box. The airscrew is driven via two shafts with a 22 gauge wire spring between them for the flexible drive. The spring will have a bearing at each end for support. The gearbox is fitted to the actual wing root as shown in the photograph.

The wing section employed is Gottingen 413 and the wing itself is built entirely from bass wood the leading edge being a channel section of 1/64 in. sheet. It seems very tough and light and capable of handling the two fully wound motors, but woe betide those front ribs when the elastic breaks!

Each wing is built as a complete unit containing motors, gearbox, airscrew and landing wheels and will be clipped to the centre section.

A Suggested Four-Engine Layout.

A far more ambitious project is the adaption of this scheme to a four-engined layout such as the Short Stirling. Actually any number of motors may be accommodated in the wings but in this case it is suggested that four be used in each wing as shown. These are all geared together at the root end as before. The actual airscrew drives are taken off two smaller gears via flexible drives as before. Adequate bearings should be provided for these drives although care must be taken to see that they do not bind.

Torque on the wing structure is obviated by using an even number of motors but the general structure will have to be strengthened to take the tension. This will mean a somewhat more robust wing than usual but the extra weight involved here may be saved on the fuselage as this latter component has now to carry but little stresses.

Figure 3 below shows details of a Short Stirling wing with the four motors arranged between two spars.

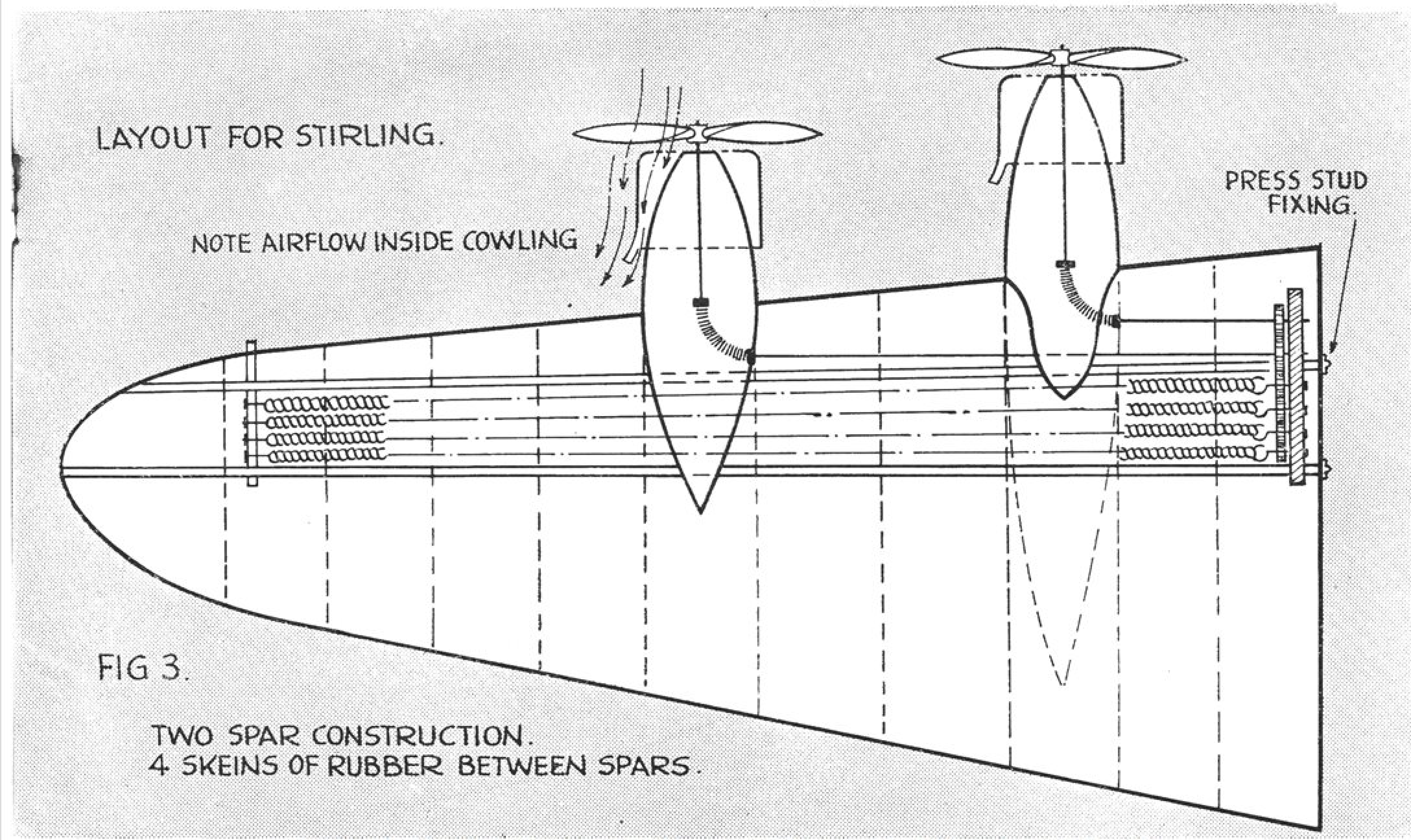
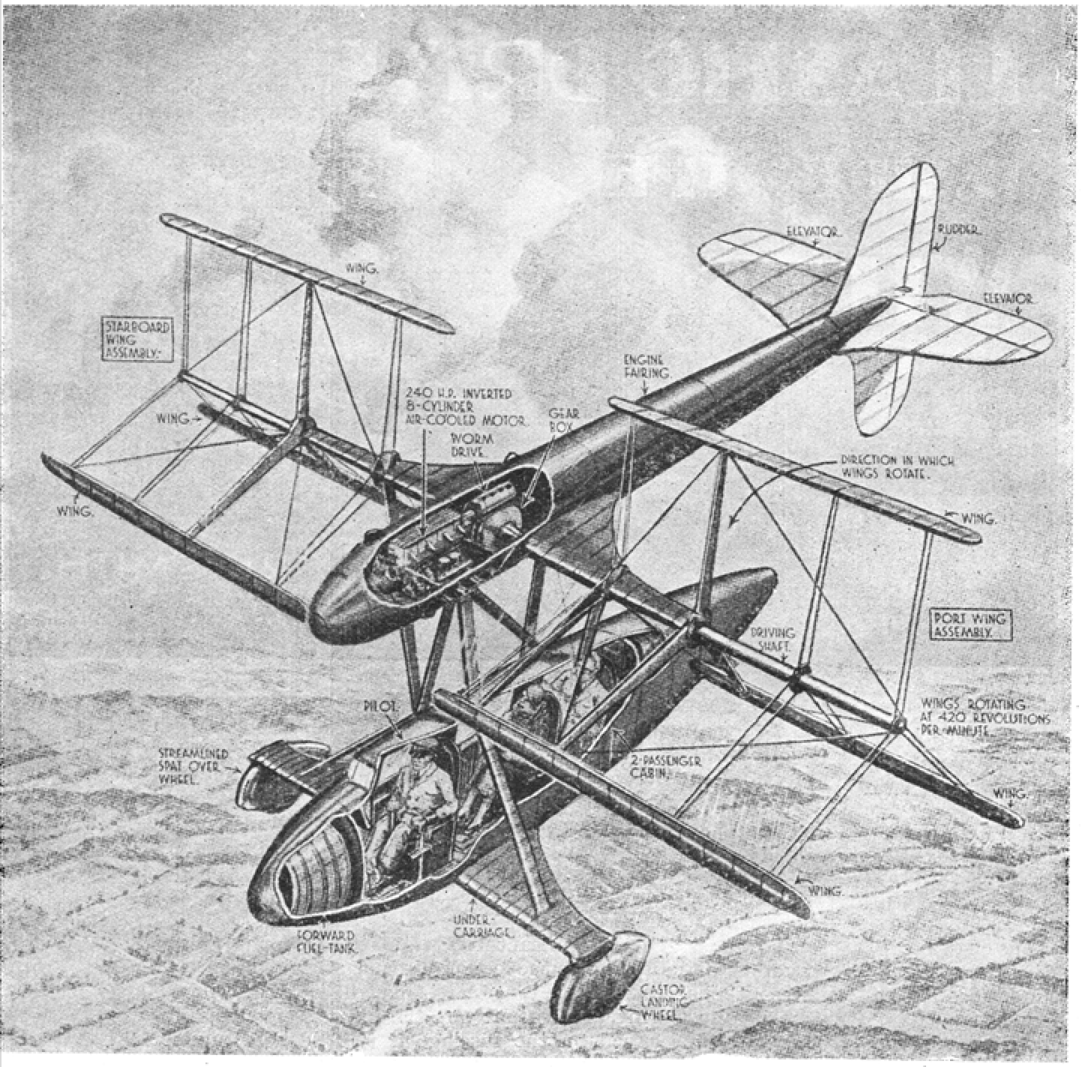


FIG 3.

TWO SPAR CONSTRUCTION.
4 SKEINS OF RUBBER BETWEEN SPARS.



By courtesy of the Illustrated London News.

A MODEL
CYCLOGIRO

As suggested by

SHERWILL COLE

In presenting this revolutionary design we offer another prize of £3 to the reader who obtains the most successful results with a model based on the one appearing on the opposite page. The only restrictions are that the " span " must not exceed 30 ins. and it must be rubber driven. Details of gearing, etc., are left to the reader's choice and some suggested modifications that may be used are given below

This leaves a remarkably wide scope for the ingenious builder and we hope to receive a good many entries. The prize will be awarded to the builder of the model which is certified as obtaining the greatest duration of flight, hand launched. A certificate giving such details must be signed by three witnesses as well as the owner of the model stating also the location of the flying ground. Entries must be sent to our Leicester Office not later than August 31st, 1942.

This little model aroused such a storm of controversy and interest in the Editorial Office that we felt quite justified in presenting it to readers even though it has never actually flown. It is not only interesting because it is a departure from the orthodox but also on account of the fact that there is a wide field of research still open as regards rotating wing aircraft. In this respect there is more than a chance that some valuable data may be obtained from experimenting with a model of this type and the following notes have been compiled by the technical staff for the guidance of intending builders.

The cyclogiro principle is sound, theoretically, but it has been somewhat neglected of late despite its obvious advantages. There should be no great worry about its performance after the power run has ceased as the aerodynamic forces acting upon the blades will ensure that they will still rotate and thus gives a certain amount of lift. Dr. Rohrbach's claim, L/D 8 : 1, seems justified. The main trouble will probably be in getting the winglets to rotate rapidly enough to generate enough lift for ascent.

Some circles express the opinion that the cyclogiro will eventually come into its own and indeed it would seem to possess, in principle at least, a definite advantage over other rotating wing craft such as the autogiro. Vertical ascent has ever been the aim of designers and this seems one of the best solutions apart from the helicopter.

In order to make a successful model it must be light and here we come up against a snag right away, for it seems that we need a most intricate system of gears to rotate the winglets. This is further complicated by virtue of the fact that they must revolve in the same direction.

It is suggested that, if the builder intends to make a sweeping change from the layout as given here, a single fuselage be employed when in all probability the flexible shaft may be dispensed with. It may even be possible to arrange separate motors for each of the two winglet systems although trouble would be experienced in matching them up. The external appearance would then be of an orthodox high wing monoplane without a propeller and with the winglet systems replacing the wings. This would also aid stability as the centre of gravity of the whole machine would be lowered.

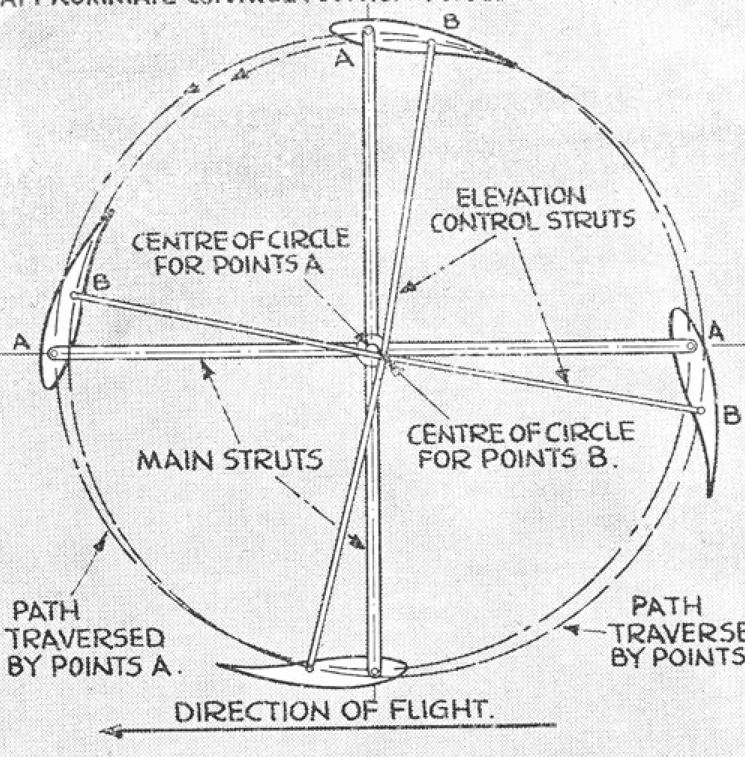
For the winglets themselves four would appear to be the optimum number for our model although some of the suggested American designs had seven or eight. The main trouble here will be a tendency for the whole system to flex upwards. The winglets bear the whole weight of the 'craft and, as their connection to the fuselage is by the control wire, this control wire—it could be called the " bearing " wire too—will tend to bow and give each winglet a generous " dihedral " angle.

There does not appear to be any immediate solution to this problem and we can only estimate its effect until the model is actually built and flown. 16 s.w.g. is the outside size of wire we can use without making the whole too heavy and if this is not adequate then the control wire must be made of brass tube of a greater diameter.

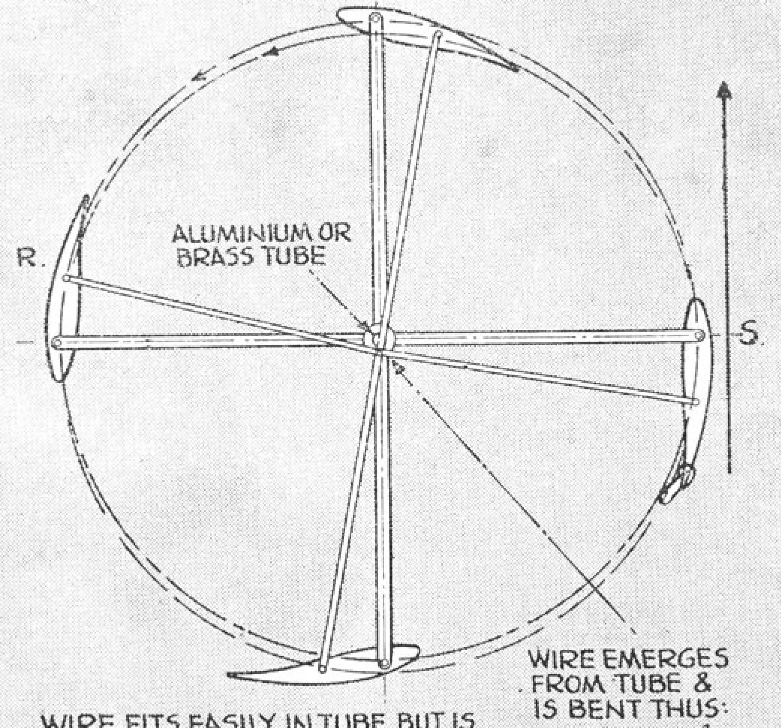
Flying trim is problematical but the centre of gravity should be under the axis of the winglets. Correct balance will have to be obtained by weights as you will not be able to shift the winglets fore and aft at will! It is suggested that an all up weight of 2 ounces be aimed at and every effort made not to exceed this figure by too great a margin. Then, with the winglets revolving at about 15 revs. per second, there is every chance that the model will leave the ground.

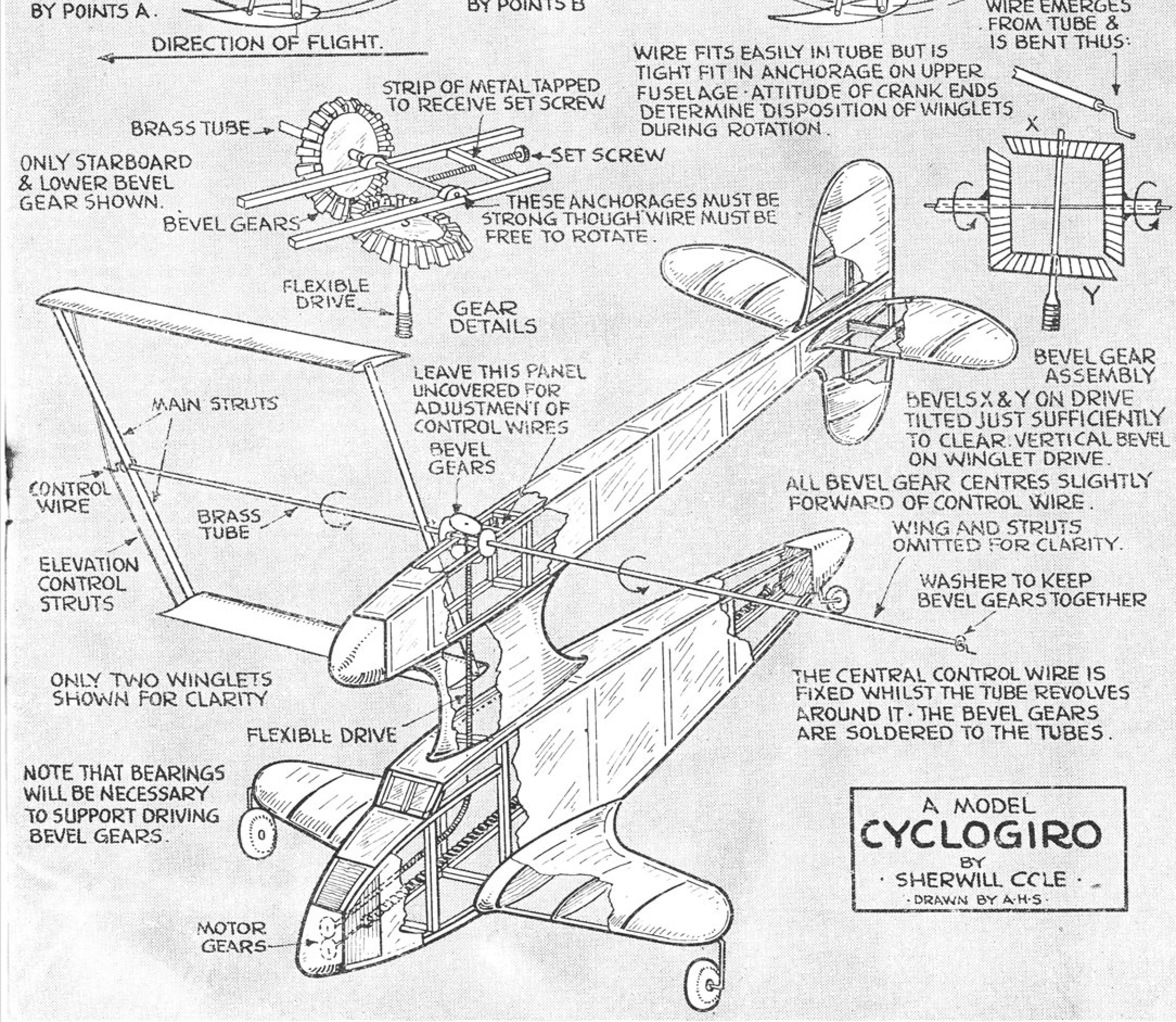
We sincerely hope that a large number of modellers will have a go at this design as there is every chance that some extremely interesting and useful results will be obtained. We will also endeavour to answer all queries on the subject (enclose a stamped addressed envelope please), and should anyone get hopelessly " stuck " we will do our best to help them out so there is every reason to expect a big entry for this novel competition. Please do not, however, ask us to *completely re-design* the model for you. These notes were compiled with the object of germinating such ideas that may already be in the builder's mind and benefiting both you and us, so—go to it!

APPROXIMATE CONTROL POSITION FOR LEVEL FLIGHT.


A
B
ELEVATION CONTROL STRUTS
CENTRE OF CIRCLE FOR POINTS A
B
A
A
B
CENTRE OF CIRCLE FOR POINTS B.
MAIN STRUTS
PATH TRAVERSED BY POINTS A.
PATH TRAVERSED BY POINTS B
DIRECTION OF FLIGHT.

APPROXIMATE CONTROL POSITION FOR VERTICAL ASCENT




WIRE EMERGES FROM TUBE & IS BENT THUS:
WIRE FITS EASILY IN TUBE BUT IS TIGHT FIT IN ANCHORAGE ON UPPER FUSELAGE · ATTITUDE OF CRANK ENDS DETERMINE DISPOSITION OF WINGLETS DURING ROTATION.
STRIP OF METAL TAPPED TO RECEIVE SET SCREW
BRASS TUBE
SET SCREW
ONLY STARBOARD & LOWER BEVEL GEAR SHOWN.
BEVEL GEARS
THESE ANCHORAGES MUST BE STRONG THOUGH WIRE MUST BE FREE TO ROTATE.
FLEXIBLE DRIVE
GEAR DETAILS
X
Y
BEVEL GEAR ASSEMBLY
BEVELS X & Y ON DRIVE TILTED JUST SUFFICIENTLY TO CLEAR VERTICAL BEVEL ON WINGLET DRIVE.
LEAVE THIS PANEL UNCOVERED FOR ADJUSTMENT OF CONTROL WIRES
BEVEL GEARS
MAIN STRUTS
CONTROL WIRE
BRASS TUBE
ELEVATION CONTROL STRUTS
ALL BEVEL GEAR CENTRES SLIGHTLY FORWARD OF CONTROL WIRE.
WING AND STRUTS OMITTED FOR CLARITY.
WASHER TO KEEP BEVEL GEARS TOGETHER
THE CENTRAL CONTROL WIRE IS FIXED WHILST THE TUBE REVOLVES AROUND IT · THE BEVEL GEARS ARE SOLDERED TO THE TUBES.
ONLY TWO WINGLETS SHOWN FOR CLARITY
FLEXIBLE DRIVE
NOTE THAT BEARINGS WILL BE NECESSARY TO SUPPORT DRIVING BEVEL GEARS.
MOTOR GEARS

A MODEL
CYCLOGIRO
BY
· SHERWILL COLE ·
· DRAWN BY A·H·S ·

"PETROIL MIXTURE"

By

Lt.-Colonel C. E. BOWDEN

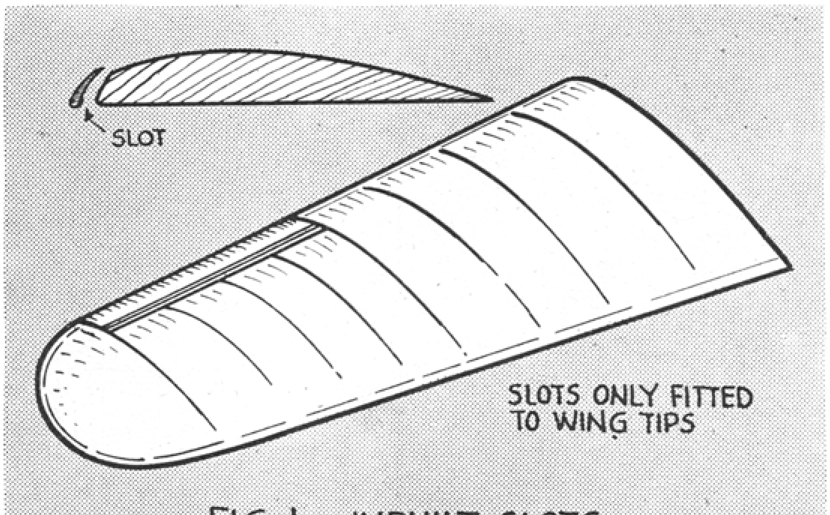


FIG. I. INBUILT SLOTS.

Two Main Problems.

In the development of any particular project it is worthwhile considering what the major weaknesses are. It is as well to tabulate them in the order of their importance, and then deal with them in that order.

Let us do this in the case of the petrol model aeroplane. At the top of my list are two major problems. My list contains several other problems which we may perhaps discuss in a later article, but in this article let us get down to the two major problems. I believe that these two subjects make or mar the petrol model aeroplane. There is a solution for them both which I will advance. In the case of some of my other problems I have not arrived at a sound solution, and I shall ask you to help in certain cases, whilst I hope to answer the rest. In this way we may pool our knowledge and be prepared for some good times after the war. Now is undoubtedly the time to take stock during our enforced rest from flying, and to record decisions for future action.

My First Problem.

How can inadvertent stall be made innocuous, so that a valuable petrol model that has probably cost its owner and creator much care and energy during its construction, shall not be damaged ? We must prevent the model from dropping a wing after the stall, as this will cause one of those destructive crashes. Even a well designed model may stall at sometime during its career.

We require a model that will sink on an even keel, if it gets into a stalling attitude, and our model must refuse to drop a wing.

The answer is quite simple, and I feel I have got the answer in the bag. I carried out a number of flying experiments before the war, and up to the time of the ban on flying petrol models. These experiments were most successful.

Provided the model is correctly proportioned and designed for normal stable flying, the fitting of my type of inbuilt wing-tip slots will end all dangers due to a dropped wing after a stall. I have emphasized the proviso in italics because a poorly proportioned and designed model will always be a hopelessly unstable proposition.

The solution to the problem is merely a matter of keeping the wing tips flying under control after the centre of the wing has stalled. The centre will therefore lift and sink whilst the wing tips are kept going by a good airflow over them through the inbuilt slots.

The wing sinks before the slotted wing tips have time to get into too acute an angle for the slots to deal with. The sinking of the wing on an even keel returns the wing to a non-stalling angle where lift is obtained again, because the tail, which is always set at a lesser angle of incidence has not lost its lift, and will remain up whilst the wing sinks.

The complete description of the experiments I carried out were published in THE AERO-MODELLER dated October, 1940, and I need not go into great detail here.

The type of slot I used is so simple to construct that it can be built into any wing with very little extra trouble.

Dr. Forster, who lives in the same home village as I do, when I am at home, also tried out these slots, and confirmed my enthusiastic report. Both of us have now thoroughly tested these slots out on varying types of petrol model and even on flying boats.

I strongly advise petrol fans to try these inbuilt slots after the war, or on large-sized gliders now. They will make your model practically crashproof even when it is grossly mishandled.

But do not slot the whole length of the wing or you will undermine the idea of controlling the wing tips whilst the rest of the wing sinks on an even keel. If you fit slots all along the wing, as the Americans are now attempting to do in a few cases, you will merely delay the stall, and fail to recover later. Fig. 1 shows the method of fitting the slots.

My slogan is : Slot your wing tips and forget the stall. It works like a charm.

The Second Problem.

Having made our models practically crashproof even under most provocative circumstances we want to eliminate wrong engine revs. and power, and all the troubles that go with uncertain ignition due to the hitherto enforced use of flash lamp batteries for the actual flight.

I suppose that most petrol fans will agree with me that there is more bad language and trouble due to loss of power, lack of revs. and even misfiring after the booster battery is disconnected just prior to the actual flight, than to any other cause.

This state of affairs is even more in evidence with the baby engines of about 3 c.c. than with larger engines around 6 c.c. and 9 c.c.

We start up our engines on the booster accumulator (never use a booster dry battery ; it is poor compared with an accumulator), and the engine runs beautifully with a steady roar and we find our mixture and there it remains.

We remove the starting accumulator and the engine either runs with less power or it soon requires readjustment of the mixture needle.

The reason is, of course, that the flash lamp battery used for flight has not a sufficient output. The voltage is there but the output is lacking. The spark is weak and this alters the type of mixture required. It usually happens that the required change of mixture occurs just as we are about to launch the model, or even worse, almost immediately after the model has been launched, just at that critical point when the model is starting its climb and is in a rather dangerous attitude near the ground. If we have our wing tips slotted there will be no crash, but it is all very annoying, and we may as well eliminate this state of affairs.

The answer is again quite simple and the cure has been found.

We must have a type of ignition that will continue with the same hot spark during flight as when the engine is being started and run up. The mixture will then not require alteration, and full power will be retained without further argument.

For some years I have been convinced that the ignition system on small petrol model aeroplanes has required a better electrical output than that obtainable from the flash lamp battery. I have advocated either the use of a flywheel magneto or a midget accumulator with the existing coil system.

It so happens that I have been in close contact with ignition systems as used on model racing speedboats, for I have done a certain amount of speedboat racing as a side line to my model petrol aeroplanes. These speedboat experiences have made it possible to draw certain conclusions.

The flywheel magneto is a very tempting idea.

Mr. Westbury, the well-known model engine designer and constructor, collaborated with me during the early days of model petrol aeroplanes. He produced an aero engine before the days of successful petrol model aeroplanes. This engine was fitted with a flywheel magneto and was of 52 c.c. It was a good engine but it was too heavy. It weighed 5½ lbs. and drove a propeller of 2 ft. diameter and 18 in. pitch. The engine was fitted into Flight-Lieutenant Comper's petrol model at the R.A.F. Station of Halton. This model did not fly, but was the direct ancestor of the famous "Comper Swift" full-sized sports aeroplane which was so successful about 1930. It proved the practibility of the small flywheel magneto.

The engine was available when I produced "Kanga," the first successful petrol model after the last war. But I decided it was too heavy for my purposes, and I used a coil ignitioned two-stroke of 28 c.c. of 2½ lb. weight with an 8 oz. coil and a 4 oz. flash lamp battery.

Later when I was engaged in speedboat work I came across Mr. Rankine and his famous water-cooled flywheel magneto two-strokes with which he has put up some startling record speeds. I still have one of his marvellous screaming engines of 25 c.c. in one of my hulls.

The great point about these magnetos is that they are absolutely reliable, and one never bothers about the ignition side. The engine is started up, the wick is turned up, and the engine screams off and remains screaming until the switches cut or the petrol fails, or the hydroplane turns over!

Incidentally there is a lot that one learns about carburettion through speedboats that can be adapted to model aero engines, but we will deal with that in a later article, I hope.

Although the flywheel magneto can be made quite compact and small, it is rather heavy, and can at present only be made by skilled people. It is also too expensive to be a commercial proposition as yet. It is therefore more sensible for the average man to consider how coil ignition can be improved.

I predict, however, that the flywheel magneto will be the ignition of the future. Just before this war Mr. Rankine and I had considered a flywheel magneto fitted to a special engine of about 9 c.c. that would be far more powerful than the 9 c.c. engines that we know at present. If the war had not taken place this engine would be flying in one of my models by now I expect. It would have been totally enclosed in the fuselage except for an air duct, and would have had an extension shaft to the nose, exactly similar to my simple type speedboat transmission. This would allow a really streamlined nose. The whole engine with ignition was calculated to weigh about 8 oz. more than the present coil system.

Normally I do not like to write about projects that have not been tried out and found a success, but perhaps I may be forgiven in this case for mentioning this project, as Hitler has done the dirty upon an interesting experiment that I feel sure would have been successful, and which I hope will yet be tried out in the not too distant future!

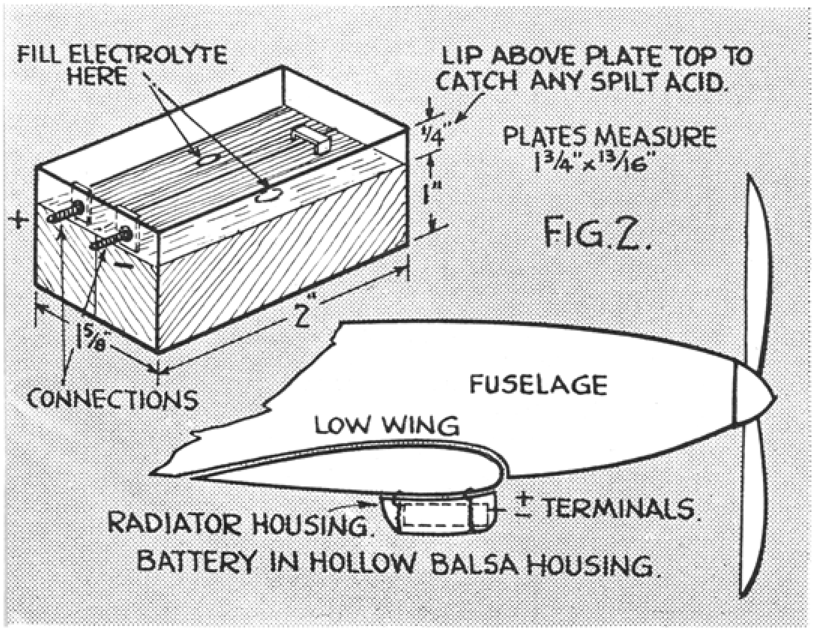
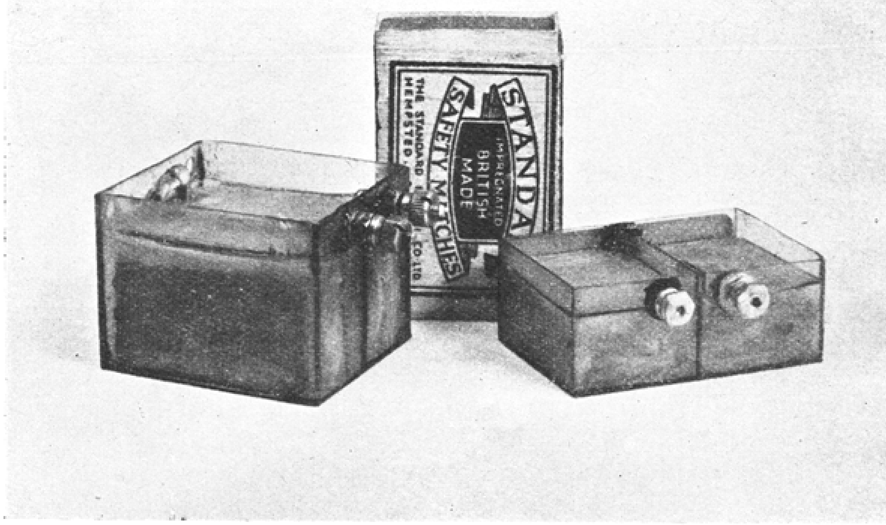

FILL ELECTROLYTE HERE
LIP ABOVE PLATE TOP TO CATCH ANY SPILT ACID.
1/4"
PLATES MEASURE 1¾"x1 13/16"
1"
+
−
2"
1⅝"
CONNECTIONS
FUSELAGE
LOW WING
RADIATOR HOUSING.
± TERMINALS.
BATTERY IN HOLLOW BALSA HOUSING.

FIG. 2.



The average man will, however, be more interested in a cheaper and more simple solution that has already been tried out and proved a success.

My friend, the "Model" Doctor Forster, and I had often talked over the problem of improving the ignition system, and we had carried out a number of experiments with improved ignition points, etc. We have wasted a great deal of time, energy and money on batteries of all shapes, combinations and sizes, and the credit for the production of the first successful 4½ oz. baby accumulator for aero use must go to him.

Most petrol men know that the dry battery of the flash lamp type has a very limited output for a given voltage, whereas an accumulator produces a far greater output of energy. It has always been considered that a very small accumulator might not stand up to the abuse it is bound to receive.

My experiences of the normal 12 oz. commercial accumulators for model speedboats has not been too happy, and in any case 12 oz. is far too heavy for aero work when using small engines.

I have tried running my original record-holding "C" class hydroplane on flash lamp batteries in order to reduce weight and make use of aero construction in boat work, but I have never succeeded in obtaining sufficient power for racing purposes on the high compression racing engine I had to use. I always had to revert to the easily obtainable 12 oz. commercial accumulator. But I see possibilities of a weight reduction all round now.

The first Forster accumulator weighed 4½ oz. and was described in "Petrol Topics" some time ago. It was very successful but of rather an awkward shape for model aero work and was spillable. We both watched this accumulator for over a year because we were decided that unless it would stand up to abuse it would not be a practical success.

It was left uncharged for long periods, and used with the plates not properly covered with electrolyte and although it was of 4 volts it was generally charged up in a few minutes from a 6 volt accumulator.

Although it had the unpleasant sort of life that a dog is supposed to have, it stuck it. I was so impressed that I had two little 4½ oz. 4 volt accumulators made up on the same lines but incorporating certain improvements more suitable for model aero requirements. These accumulators are very successful and have proved to me that the old bogey of dry batteries is a thing of the past.

Full power and a constant power output from a sound engine is to be expected in the future. No more flash lamp batteries for me!

My accumulators are of a flatter shape than the original experimental model and the terminals protrude from one end. There is an extension of the casing on the top that catches any excess of acid, and the accumulator is filled with glass wool that can be saturated with acid and yet will not spill over the model if it should turn over on its back.

I like to sling my accumulators below the belly of a high-wing machine or below the wing of a low-wing model, and to attach the accumulator to the model by elastic so that it will not suffer damage by unforeseen shock. I dislike totally enclosed and inaccessible batteries or accumulators.

The new type permits all these idiosyncrasies. It can be placed in a dummy radiator casing with the two terminals protruding from the intake end. One can then strap on two crocodile clips to boost the accumulator on the field from the 6 volt motor cycle type accumulator used for this purpose, and there is no necessity for extra complications of boost plugs fitted to the model. This eliminates two extra joints which are all sources of possible electrical trouble.

By the way, one should be careful when boosting the baby accumulator that the ignition points are open, or the coil will cook instead of the accumulator! The accumulator can take it but the coil may not!

Fig. 2 shows the main dimensions of the baby accumulator, also the method of housing the accumulator in a dummy radiator slung below the machine.

Operation of the Accumulator.

The accumulator is placed on charge before the day's flying. This may be done from a large 6 volt accumulator with a resistance such as a 2½ volt flash lamp bulb in series to reduce the rate of charge, or if a trickle charger is available one can charge it up for an hour or two at ½ amp. I find that it does not require too long. Experience will dictate the correct amount, but it is as well I find to watch the accumulator from time to time as it seems to quickly "come to the boil," and damage will be done if too much charging is indulged in. In warm weather it is quite possible to obtain a number of starts and flights without a recharge, but I like to use my 6 volt booster accumulator to start up with, and, after a flight or two give a short charge of ½ a minute to 1 minute.

The electrolyte bubbles and froths in rather an alarming manner but provided only a little of this is allowed, it does not seem to buckle the plates.

Maintaining the Accumulator.

Topping up with distilled water is fairly frequently required with this violent charging. A fountain pen filler is the only really feasible method.

Owing to possible spillage if one does not use wool inside the accumulator, and the model decides to turn over on its back in a ploughed field, it is as well to occasionally empty out the accumulator and fill with new electrolyte of the correct normal specific gravity. This can be kept in a bottle ready for use in the workshop, or even robbed from the large accumulator, provided one occasionally has the large accumulator topped up with acid and water.

Smaller Accumulators yet.

Both Dr. Forster and I are trying out even smaller accumulators weighing only 2½ oz. These will be absolutely ideal for the midget type of petrol model. But it is too early yet to say whether these tiny cells will be a lasting success.

Three more Problems—The next on the List.

Reliable carburation. Undercarriages that will "Take it." A device that will turn the model into wind and keep gliding into wind after the engine has cut.

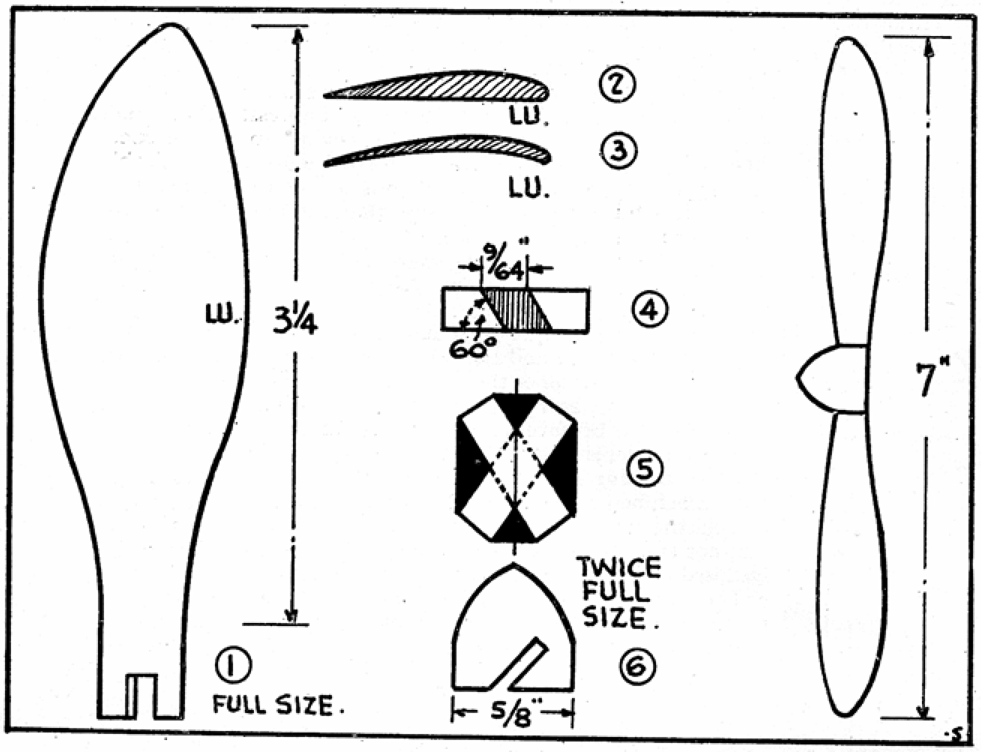
I will answer the first two problems, can you provide the answer to the third?

The 3-E Propeller

By JOHN FIELDHOUSE

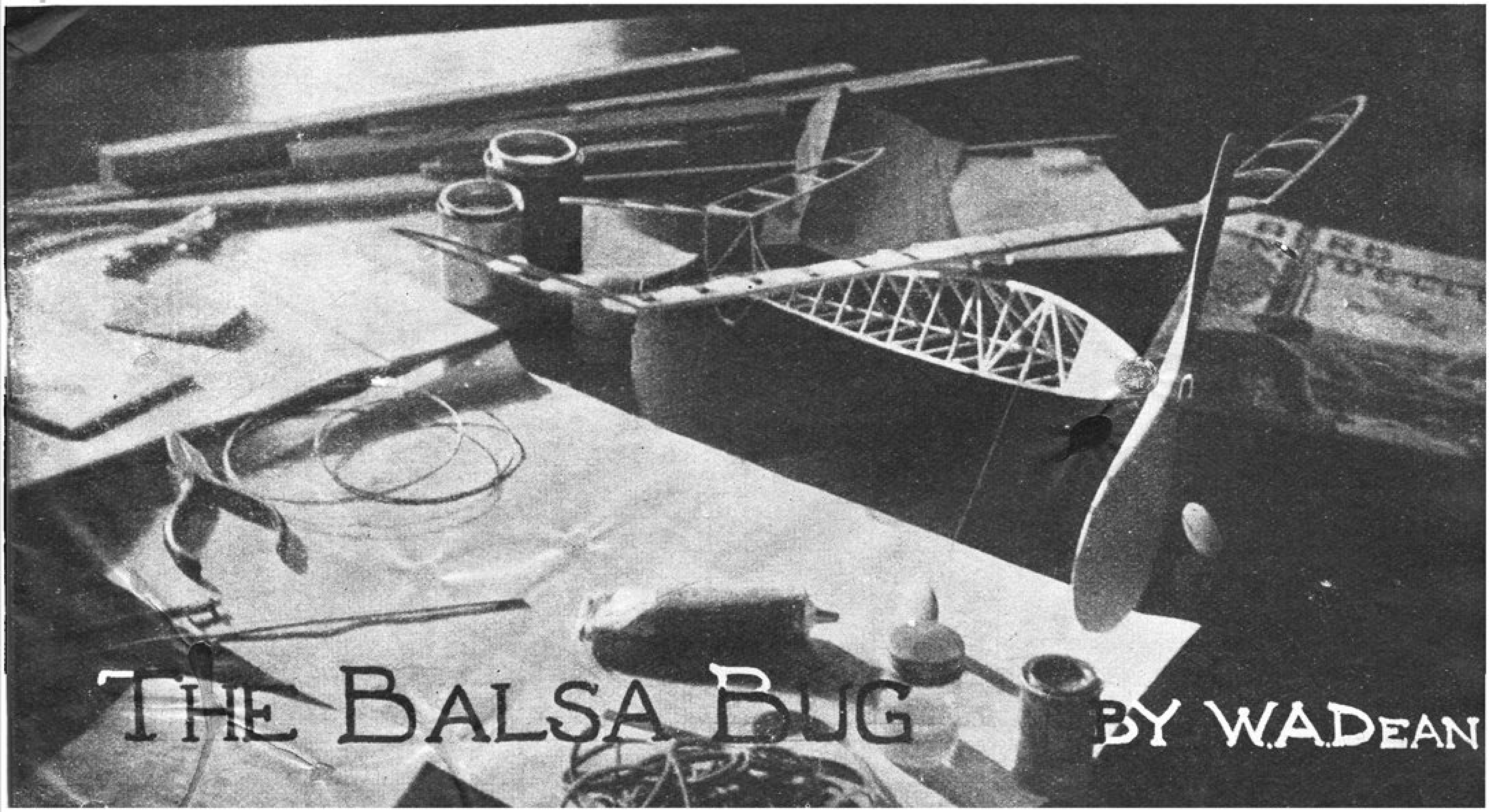
THIS propeller may be described as efficient, economical and easy to make—hence the name. It would be a mistake to sacrifice efficiency for other considerations, even economy of materials, but this construction lends itself to the building of really efficient propellers to almost any data, while retaining its economy and ease of construction. Wartime scarcity set the problem of the propeller and this is an answer to it. For the sake of clearness a 7 in. prop. will be described, but the same construction holds good for any other size and type.

From 2 in. × ⅛ in. satin pine (balsa substitute) cut two blades of the same shape. Each of these blades must be treated in exactly the same way. Lay each one down in the way shown (Fig. 1) and mark the leading edge underside LU. Turn over and with a sharp knife carve the blank to the section shown (2) to within ½ in. of the root end, which is left rectangular. Now sandpaper the underside along 3¼ in. of its length from the tip, until the section is as in 3. The next step is not difficult but requires care, as on this depends the angle of the blades at the root, which may, of course, be altered as desired. In this case two cuts ¼ in. long and 9/64 in. apart are made at an angle of 60° to the horizontal (4). This will give an angle of attack 60° at the root and will set the blades at 60° to each other. If it were desired to set the blades at 90° to each other, giving an angle of attack 45° at the root, one need only make the two vertical cuts ¼ in. long and ⅛ in. wide exactly. Each blade is now twisted; this presents no difficulty as the amount of twist is much less than with the old bentwood prop., depending on the angle at the root. The best way of doing this is to heat the blade in front of a fire. Whilst hot (holding it firmly at the root along ½ in of its length with one hand and at the tip of the blade with the other), and *looking towards the underside* twist the blade at the tip in a clockwise direction through (in the case in question) an angle of 30°. Hold it there a minute or so until it cools, when it will be set in position.



The blades are now finished and may be locked together. Hold one blade horizontal in the left hand, underside facing and leading edge on top, and the other in the right hand, top side facing and leading edge also on top. Put roots together, turn blade in right hand clockwise through 60° and push together. If cut accurately they will then be locked firmly together and may be glued. The angles at the centre may now be filled in for ½ in. with wood to form a boss as shown (5). This can then be drilled and bushed if desired.

A spinner may now be made and fitted, which will improve the appearance and the efficiency of the prop. It should be of the shape and dimensions shown (6), having two slots cut in the sides to accommodate the prop. blades at the correct angle. Make it a tight fit and then, while concealing and protecting in flight any free-wheel device which may be used it can be removed for winding purposes. The writer has found that a *papier mâché* spinner, formed on a waxed rod of the correct shape at the end, is very strong and light, but no doubt other ways will suggest themselves to the readers.



THE BALSA BUG

BY W.A.DEAN

General Features.

This little model was built mainly with the idea of trying out the triangular type of fuselage.

To my way of thinking the advantages of the triangular fuselage are many and varied. In the first place there is a definite saving in weight since less wood is used (an important point in these days of balsa shortage !), so that it weighs less even than the simplest form of the square box.

Triangulation of members, too, gives greater rigidity to the whole structure so that the builder need not be worried on this score.

It is particularly suited to the smaller type of model with fuselage length up to about 30 inches but in the Wakefield class we come up against other difficulties. In order to get the fuselage cross-sectional area required by the rules the triangle must be relatively large, thus resulting in a wide, clumsy shape and so it is out of the question here.

The " Balsa Bug " is a typical example of a triangulated structure applied to a small model. The plans on the following pages are drawn full size so it is only necessary for the builder to trace them on greaseproof or tracing paper or build directly over them. There is ample room for the motor, which, owing to the point of the triangle being uppermost, is relatively low slung. This gives a fairly low centre of gravity position which is helpful.

Simplicity of construction is aimed at as far as possible and the following notes are for the builders' guidance.

The Fuselage.

Build two sides on the plan, the same as for a rectangular type fuselage. Then trim away the inside of each top longeron so that a triangular section is formed, the point being at the top. The two sides are now held together at these two longerons, the lower ones splay out at a sharp angle. These two longerons can now be cemented and bound together. Cut the lower spacers to the same length as in the side view and cement in place. Now add the ply nose former and remove the binding from the top longerons.

Next bind the wing mount and undercart legs in position. Finally make the tail mount and fix in position, making sure that it is quite upright.

Wing and Tailplane.

The wing construction is quite normal except for the omission of a main spar. Pin the three parts down whilst they are drying. The tips being cemented to the centre portion afterwards to give a 1¾ in. dihedral under each tip.

The tailplane construction is similar to that of the wing tips except that 1/16 in. square braces are used instead of ribs.

Propeller Assembly.

The propeller used is a standard 8 in. American type given two coats of banana oil.

The freewheel is self-explanatory. Make the nose piece from a piece of scrap balsa.

Covering.

The fuselage is covered in three pieces, working forward from the tail peg.

The underneath portion and tail is covered in two pieces, one for each side.

The remaining two sides and tail mount are also covered by one piece for each side. First attach the tissue to the top of the tail mount, allow to dry and then pull taut so that the tissue does not touch the top longerons. When doped, a very pleasing fillet results as well as making the tailplane a more rigid fixing.

The wing is covered in six pieces and the tailplane in three.

The original colour scheme was a white fuselage, red wings and tailplane. Two coats of dope were given to the fuselage and one to the wings and tailplane after first spraying with water.

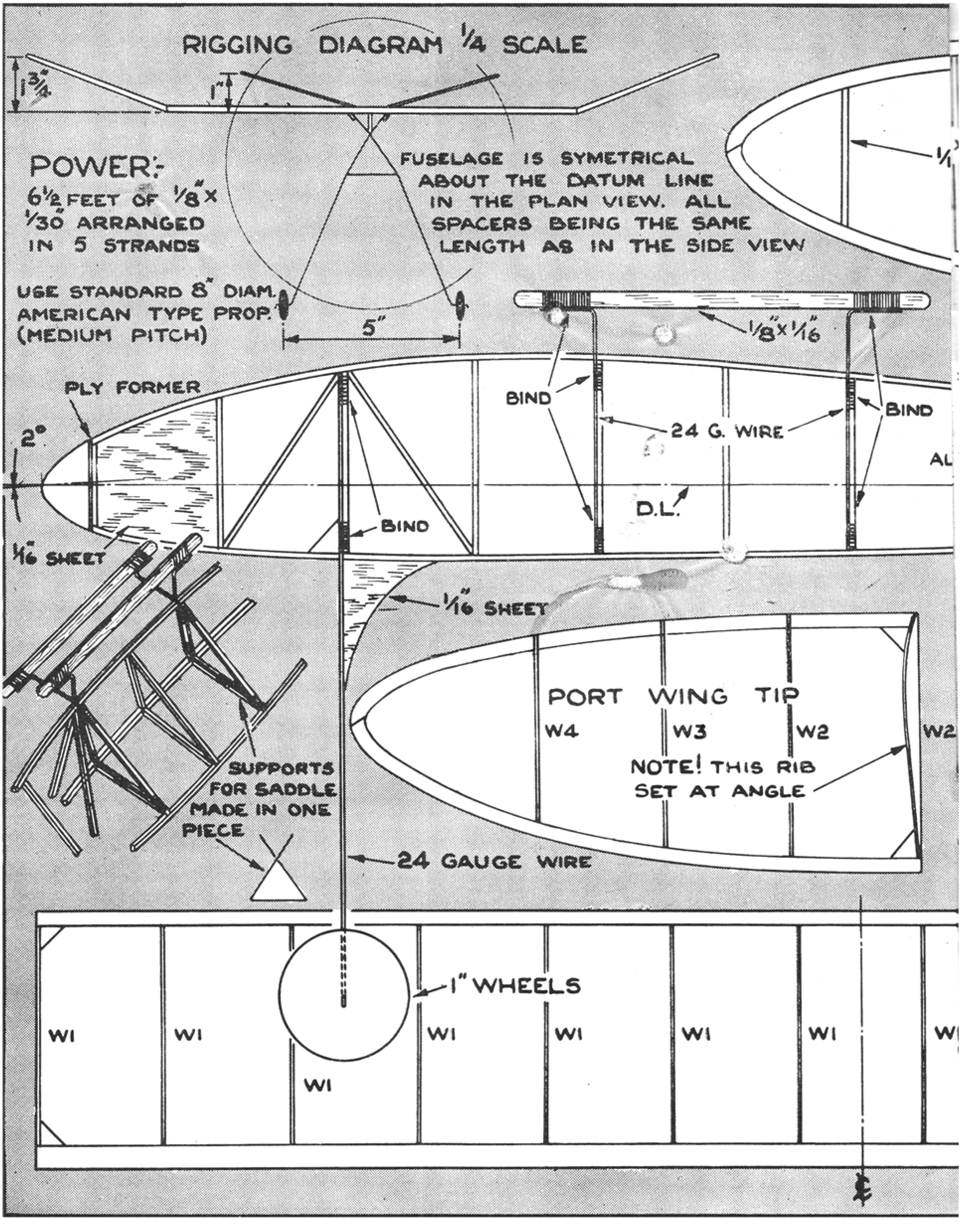
Flying.

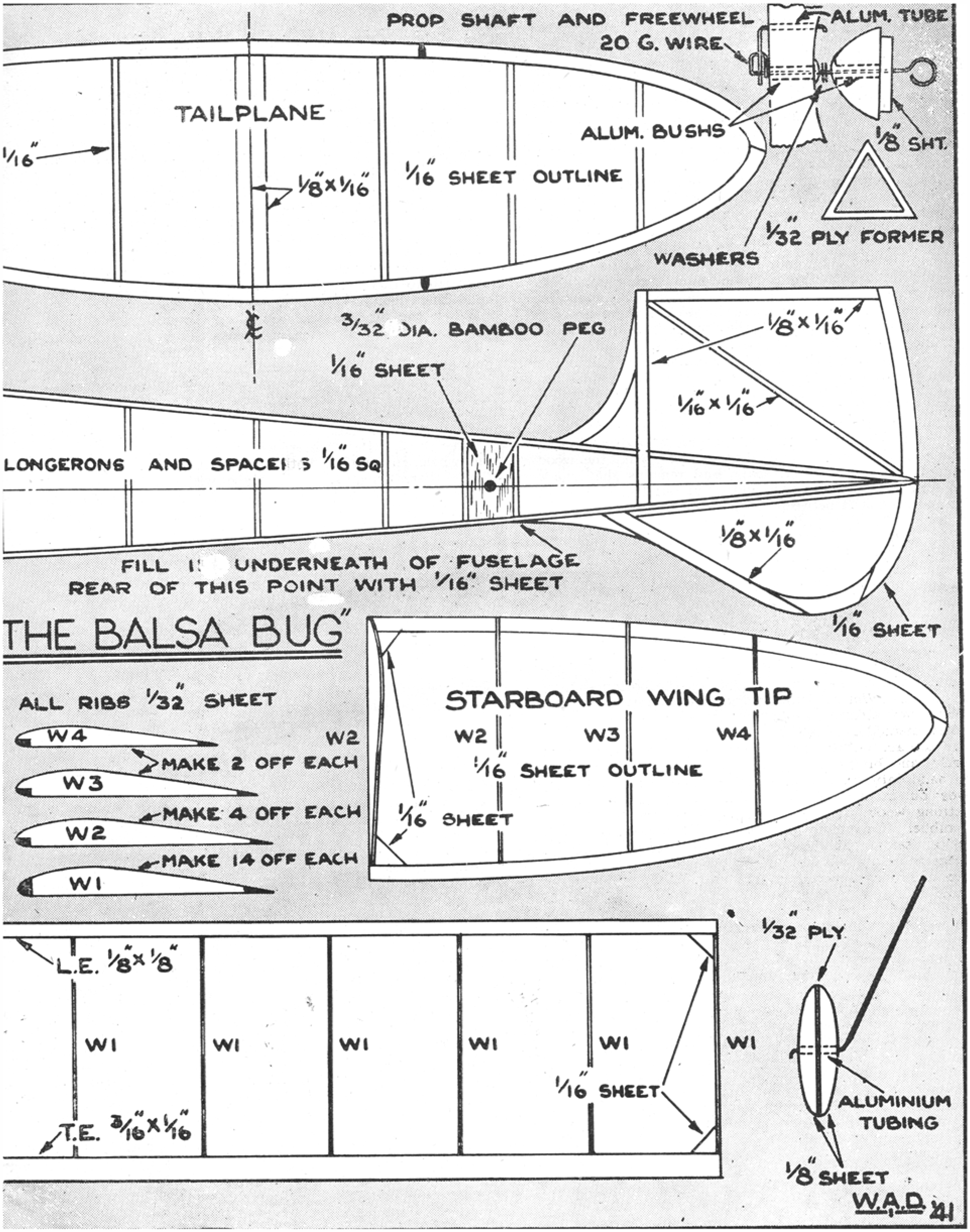
Complete with rubber the model should balance at about midway between the leading and trailing edges of the wing. First of all check for glide, adding up to 2 degrees incidence if necessary to the mainplane.

I always find that a good plan before venturing out with a new model is to test fly it round the pole.

Anyhow, when you are satisfied, give about fifty turns and hand launch. Stretch-wind the rubber and gradually increase the amount of turns until 500 is reached if the trim is correct. After that figure it's your own responsibility what happens, although before now I have had 700 turns with a well run-in motor.

Best duration to date is 45 seconds in rather poor weather, but I hope to put up some better times under more favourable conditions.


RIGGING DIAGRAM 1/4 SCALE
1 3/4"
1"
POWER:-
6 1/2 FEET OF 1/8" x 1/30" ARRANGED IN 5 STRANDS
FUSELAGE IS SYMETRICAL ABOUT THE DATUM LINE IN THE PLAN VIEW. ALL SPACERS BEING THE SAME LENGTH AS IN THE SIDE VIEW
USE STANDARD 8" DIAM. AMERICAN TYPE PROP. (MEDIUM PITCH)
5"
1/8" x 1/16"
PLY FORMER
BIND
24 G. WIRE
BIND
2°
BIND
D.L.
1/16" SHEET
1/16" SHEET
SUPPORTS FOR SADDLE MADE IN ONE PIECE
PORT WING TIP
W4
W3
W2
W2
NOTE! THIS RIB SET AT ANGLE
24 GAUGE WIRE
1" WHEELS
W1
W1
W1
W1
W1
W1
W1
W1


PROP SHAFT AND FREEWHEEL
20 G. WIRE
ALUM. TUBE
ALUM. BUSHS
1/8" SHT.
1/32 PLY FORMER
WASHERS
TAILPLANE
1/16"
1/8"×1/16"
1/16" SHEET OUTLINE
℄
3/32" DIA. BAMBOO PEG
1/16" SHEET
1/8"×1/16"
1/16"×1/16"
LONGERONS AND SPACERS 1/16" SQ
1/8"×1/16"
FILL IN UNDERNEATH OF FUSELAGE
REAR OF THIS POINT WITH 1/16" SHEET
1/16" SHEET
"THE BALSA BUG"
ALL RIBS 1/32" SHEET
W4
MAKE 2 OFF EACH
W3
MAKE 4 OFF EACH
W2
MAKE 14 OFF EACH
W1
STARBOARD WING TIP
W2
W2
W3
W4
1/16" SHEET OUTLINE
1/16" SHEET
L.E. 1/8"×1/8"
W1
W1
W1
W1
W1
W1
1/16" SHEET
T.E. 3/16"×1/16"
1/32" PLY
ALUMINIUM TUBING
1/8" SHEET
W.A.D. '41

"LITTLE WILLIE"

By the Rev. W. P. WYLIE

"LITTLE WILLIE" is the result of my association with the local Air Scouts. No doubt the experts will raise their eyes in horror; no doubt they will point out that he is far heavier, and also stronger, than he need be; that he has a most inefficient form of tail; or that just a little more trouble here and there would have produced a more efficient machine. But it is just that extra trouble that you, the complete novice, are at present unable, though far from unwilling, to take. "Little Willie" is deliberately designed for you; the person who has never yet made a 'plane, and who knows next to nothing about how to do it or to fly it. As far as is humanly possible snags have been avoided. On the other hand, by building "Little Willie" you will learn a lot about modern methods, gain invaluable experience, and also find the thrill of flying a model of your own.

I am going to be fairly detailed, because there are odd points which no one ever tells the novice, but which are of great importance. First and foremost make a copy of the plan. You must work from full-size plans. You may think you can do without these; you can't. Start with the fuselage. Here is one of the difficulties that cannot be avoided, the curving of the longerons. Don't be tempted just to bend them and hope they will stick when the cement dries. Cut four pieces, slightly longer than necessary, and hold each of them in the spout of a boiling kettle. Bend the wood until it takes the required shape and remains that shape when dry. Start at the nose end. Cut out the $\frac{1}{8}$ in. sheet piece and cement it between the front ends of the longerons. Now cement in the spacers, having carefully cut them to the required size. Don't cement the sheet at the tail end until you reach that end, and be very careful indeed that the top longerons are absolutely level and straight. If they warp at all they must curve downwards; an *upwards* curve would make the tail-plane have more lift than the main-plane, and would be absolutely fatal. Note the four right-angle pieces at the third spacer from the front. Put these in and join the two sides by spacers top and bottom in the middle where they lie parallel to each other. Wait until these are dry and then cement the triangular piece on the bottom side of the tail end. Wait until this is dry, and be quite sure about it before you attempt to join the nose-pieces together. The simplest method of doing this is to stick the $\frac{1}{8}$ in. sheet pieces to the top and bottom of one side; then, when firm, cement liberally and bring the two sides together. Hold firmly in your hand until dry, and the fuselage is finished.

Now put in the sheet which holds the dowel—small piece of strong wood, bamboo, birch, etc.—for the rear end of the rubber. Cut out two pieces of $\frac{1}{8}$ in. sheet and two of 1/16 in., seeing that the grains run in different directions. Cement these together, one of each in pairs, and cement in behind the third spacer from the rear. Now bore a hole through each for the dowel.

Now we will proceed to the wings, which are in reality quite simple. Cut out the mainspar of 1/16 in. sheet. Cut out fourteen ribs of the same. Notch the front of each rib so that it will receive the leading edge, which is $\frac{1}{8}$ in. square set diamond fashion. Cut out the trailing edge. This has notches to receive the ribs. The ribs and the mainspar have notches to fit in with each other. Be very careful to cut all these notches deep enough, 3/16 in., *and not too wide;* 1/16 in. only; everyone tends to make them too wide.

Now put a little cement in the notches of the mainspar and the ribs, and place the ribs in position. While these are drying put the trailing edge in place; all, of course, on a flat board or table. When dry cement in the leading edge. Note that though the mainspar is in two parts, the leading and trailing edges are in one piece, so that both wings are made together as one. Now for the centre-section. Cut a piece of 1/16 in. sheet 2 in. by $3\frac{1}{2}$ in. Cement the trailing and leading edges on to this. The mainspars should now just be touching. Crack the leading and trailing edges immediately *inside* the two centre ribs so that the wings will bend upwards for dihedral. Cement the mainspars to the sheet bed-plate, and hold them firmly in position by two pieces of 1/16 in. sheet cemented on each side of the join. Now cement on the 1/16 in. by $\frac{1}{4}$ in. lateral edges and the wings are finished.

Before beginning to cover with tissue, the undercarriage wire must be attached to the fuselage. Bend to shape and bind and cement it to the spacers as shown.

Now for covering. Use "Gripfix" and apply with the finger. Cover fuselage and wings one section at a time. Do not be tempted to go more quickly or you will only meet with trouble. Stretch as taut as possible and avoid wrinkles. When covering the wings be sure that you get the tension *laterally*, otherwise the wing section will not be true. Cover from rib to rib, stretching that way, *not* from trailing edge to leading edge.

When the fuselage and wings are covered take a paint brush and a mug of water, and paint the whole with water. You will be horrified at the result. Everything will go soft and soggy, and you will think it ruined. But wait until it dries and you will find the tissue is now tight as a drum—or should be. Now dope and you will be quite amazed at the strength of the structure that results.

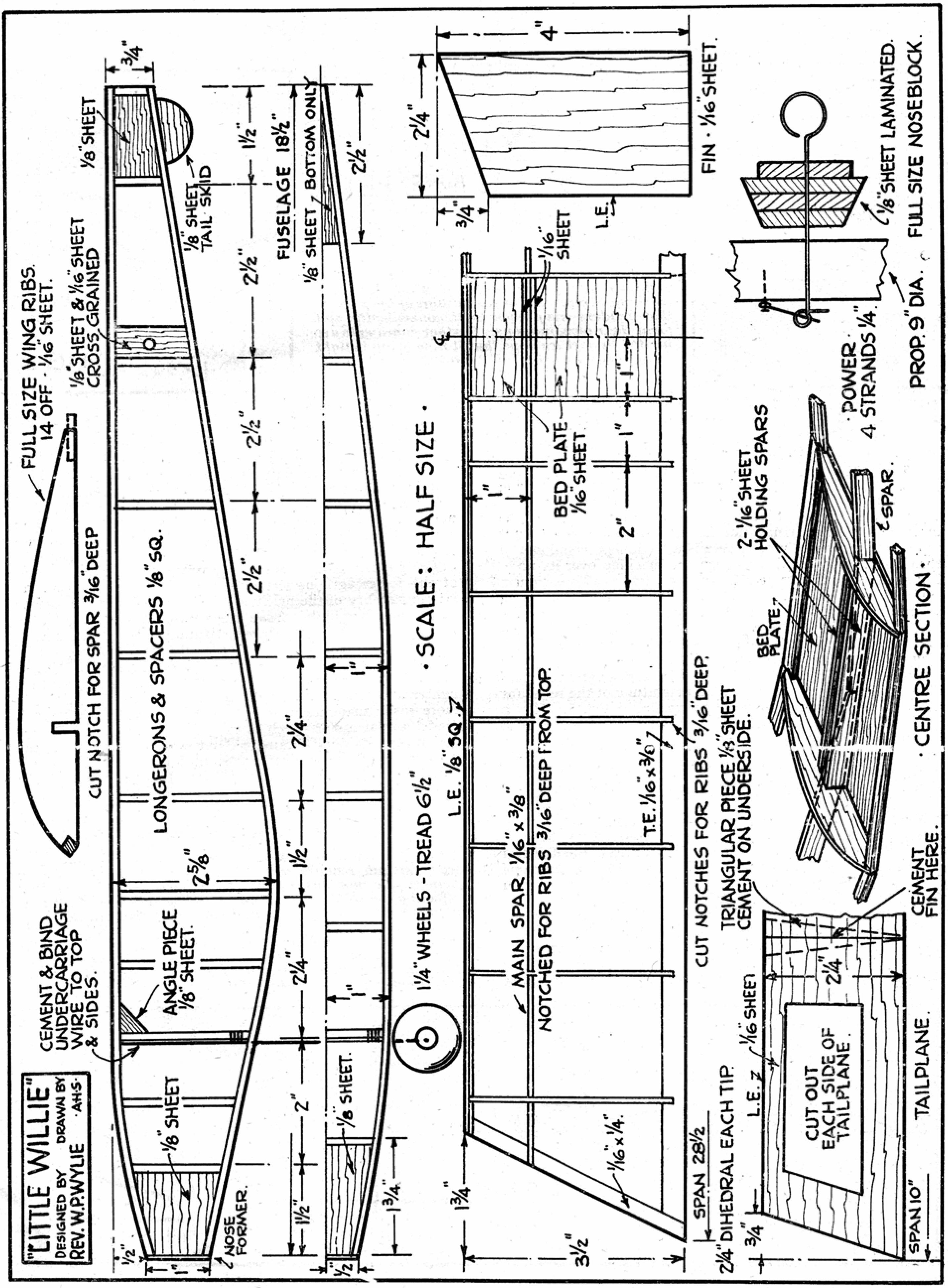
There only remain a few extras now. The tail-plane is cut out of 1/16 in. sheet, with part cut-out for lightness, the whole covered on both sides with tissue. The fin is sheet, tissue covered. Dope these without painting with water first. Cement the fin on to the centre line of the tail-plane and hold it there with two small angle pieces. Cement a small piece of $\frac{1}{8}$ in. sheet, triangular-shaped on the underside of the tail to fit in the top of the fuselage and hold the tail in place. Cut four small squares of $\frac{1}{8}$ in. balsa, and cement to the front and back of the centre-section ribs of the main-plane. These are to hold the rubber bands which attach the 'plane to the fuselage.

Wheels for the undercarriage can either be bought or made from balsa. The original model had $1\frac{1}{2}$ in. celluloid wheels which I happened to have.

There now only remains the motive power. The propeller should be purchased—until you are expert enough to carve your own—which I am not. A 9 in. is the most suitable. A free-wheel device is shown. The reason for this may be a mystery to some novices, but it is an absolute necessity. When the rubber has run out, if the propeller was fixed and could not turn its head, resistance would be sufficient to prevent the model from gliding. You will soon discover that the glide, after the power has run out, is frequently by far the longest part of the flight, and to get this the propeller must be free to revolve. Two pins, one stuck into the propeller, the other twisted round this one, and cut short, will do. The hanging one then engages in a loop in the wire shaft and presses against it while winding up and under power, but falls free when the rubber has run out.

The wire shaft goes through a hole in the centre of the propeller and through another hole in the nose-block, and is then formed into a hook for the rubber. The nose-block can either be carved out of a piece of solid balsa or made by putting three pieces of $\frac{1}{8}$ in. sheet, cross-grained, together, cementing them and pressing down with a heavy weight. Add one more piece to make a butt to fit into the nose former.

Now for the rubber. Use $\frac{1}{4}$ in. strip rubber of best quality. Cut sufficient to make a four-stranded skein about 1 in. longer than the distance between the nose-block and the rear dowel. Lubricate this well with rubber lubricant—a messy but necessary job. The rubber must be tied. It will do if it is knotted before lubrication, but far better tie it with thread when stretched out tight. Hook one end of the skein on to the propeller hook. Tie a long piece of thread or cotton to the other end, with a small weight attached to the other end of the cotton. Drop weight and cotton through the nose former and let it out at the top rear of the fuselage. You can now pull the rubber right through. Pull it through and, looking into the fuselage, push the wooden dowel through between the strands. Now put the nose-block into position.


"LITTLE WILLIE"
DESIGNED BY REV. W.P. WYLIE
DRAWN BY A.H.S.
CEMENT & BIND UNDERCARRIAGE WIRE TO TOP & SIDES.
ANGLE PIECE 1/8" SHEET.
1/8" SHEET
NOSE FORMER.
LONGERONS & SPACERS 1/8" SQ.
CUT NOTCH FOR SPAR 3/16" DEEP
FULL SIZE WING RIBS. 14 OFF · 1/16" SHEET.
1/8" SHEET & 1/16" SHEET CROSS GRAINED
1/8" SHEET
1/8" SHEET TAIL SKID
FUSELAGE 18 1/2
1/8" SHEET, BOTTOM ONLY
1/8" SHEET.
3/4
1/2"
1"
1 1/2"
2"
2 1/4"
2 5/8
1 1/2"
2 1/4"
2 1/2"
2 1/2"
2 1/2"
1 1/2"
1 3/4
1"
1"
2 1/2"
1 1/4" WHEELS - TREAD 6 1/2
· SCALE : HALF SIZE ·
4"
2 1/4"
3/4"
L.E.
FIN · 1/16" SHEET.
1/16" SHEET
BED PLATE 1/16" SHEET
1"
1"
1"
2"
L.E. 1/8" SQ.
MAIN SPAR 1/16" x 3/8"
NOTCHED FOR RIBS 3/16" DEEP FROM TOP.
T.E. 1/16" x 3/16"
CUT NOTCHES FOR RIBS 3/16" DEEP.
1/16" x 1/4".
1 3/4
3 1/2"
SPAN 28 1/2
2 1/4" DIHEDRAL EACH TIP.
1/8" SHEET LAMINATED.
FULL SIZE NOSEBLOCK.
POWER: 4 STRANDS 1/4.
PROP. 9" DIA.
2-1/16" SHEET HOLDING SPARS
℄ SPAR.
BED PLATE
· CENTRE SECTION ·
TRIANGULAR PIECE 1/8" SHEET CEMENT ON UNDERSIDE.
CEMENT FIN HERE.
L.E.
1/16" SHEET
2 1/4"
CUT OUT EACH SIDE OF TAILPLANE.
3/4
TAILPLANE.
SPAN 10"

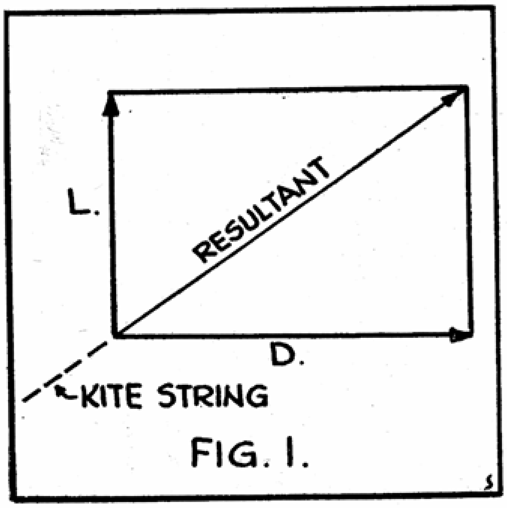


FIG. 1.

A QUESTION OF DOWNTHRUST

by F. PETRI

An article by Mr. B. R. Aldridge in the February issue seems to have reawakened interest in the old controversial subject of downthrust, but this time in a slightly different light. The original diagram that forms the subject of this controversy is reprinted at the bottom of the page so that readers may refer to it conveniently and form their own opinions. Further comments are invited, in fact we hope that it may bring to light some new theories on longitudinal stability.

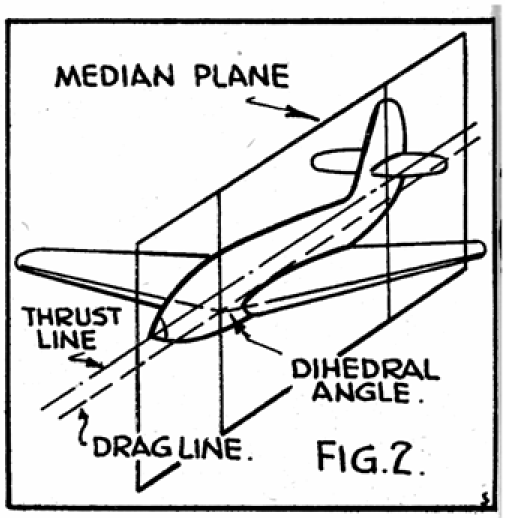


FIG. 2.

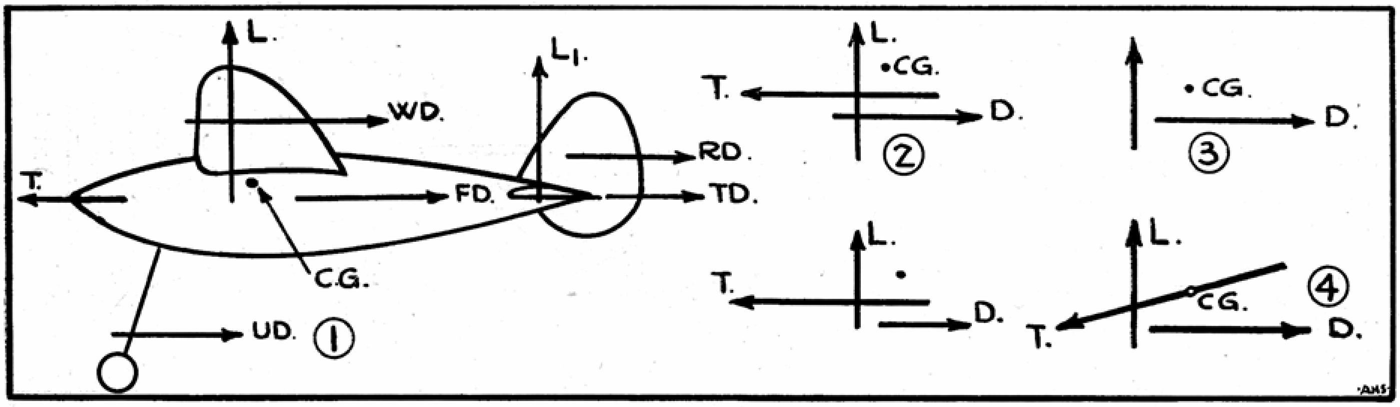
I FEEL there is something wrong about Mr. B. R. Aldridge's "Discourse on Down-Thrust" in the February number of THE AERO-MODELLER.

In the first place his diagrams do not represent the facts. He is not entitled to omit the action of the weight from them. Here, by the way, occurs the only instance in the moving system in which the term "balance" can be correctly used: the weight balances the lift in the particular case when the machine is neither rising nor falling. Diagram 2 does not represent an equilibrium. There is a "couple," composed of thrust and drag, tending to turn the machine over its nose. The same effect is obtained by trying to drag a tall box along a surface by pulling on its top edge. In diagram 3 lift and drag are not balanced as he claims, but have a "resultant" which he does not show. This would act in a more or less "north-east" direction, the exact direction depending on the relative magnitudes of the two forces. If these are quantitatively represented on some definite scale by the lengths of their lines of direction, the direction and magnitude of the resultant are obtained to the same scale by means of Fig. 1. If this Vector Diagram is taken to represent the forces acting on a kite instead of an airplane the resultant is balanced by the string, which will have the same inclination, and the magnitude of the resultant can be read off by means of a dynamometer. This is the true use of the word "balance," i.e. applying to a static not a moving system.

The total drag may be considered to be concentrated along a certain line, which in a symmetrically constructed machine will lie in the median plane, the one which bisects the dihedral angle and in which the thrust-line lies (see Fig. 2) in the same way as the centre of gravity is the point at which the total weight of the machine appears to be concentrated. If the line or the drag is (*a*) above or (*b*) below the thrust-line the drag and thrust will form a mechanical "couple," the effect of which will be to pull the nose of the machine (*a*) up or (*b*) down. But if the line of drag coincides with the thrust-line there will be no "couple"; the thrust will merely overcome the drag like the winning side in a tug-of-war. In this case neither up nor down-thrust is needed. This explains why we must generally use down-thrust with a high-wing machine. In any well-designed machine most of the drag is produced by the wings, hence in a high-winger the line of drag will be high and in a low-winger low. This also explains Mr. Knight's observation (and my own, alas!) of the habit of low-wing machines to dive when under power. This tendency should be curable by using up-thrust, or at least an absence of down-thrust.

The position of the centre of gravity has no effect on any of the foregoing considerations. Its only effect is upon the lateral stability of the machine. In a high-winger the surface of suspension will be above the centre of gravity and the machine will be more or less naturally stable. In a low-winger the centre of gravity may easily be above the surface of suspension and the machine will be unstable. This is probably one reason why the low wing has been adopted for fighter and, indeed, most service machines, as they are then more easily manœuverable. The moral is, then, that in all model airplanes, for which in the absence of a pilot we want the utmost stability obtainable, and especially in low-wingers the centre of gravity should be as low as possible. This contradicts Mr. Aldridge's conclusion, but the proof of the pudding is in the eating, and I commend it to the appetite of the great body of aero-modellers.

There is plenty of food for thought in these few lines and we trust that readers will give them more than a passing glance. Do not lose sight of the fact that in problems affecting the stability of the machine the action of the forces about the centre of gravity must be considered but that also in the case of longitudinal stability discussed here the position of the centre of resistance is of great importance. Obviously if the centre of resistance is far removed from the thrust line there will be a great divergence between "engine on" and "engine off" trim.



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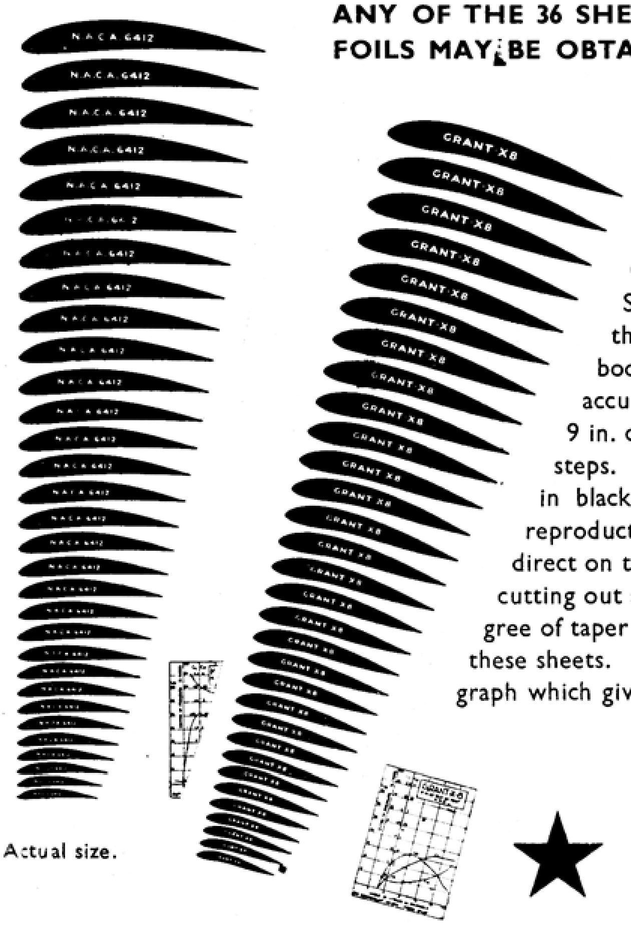

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N.60 - - - - -	S/34
C.72 - - - - -	S/35
MARQUARDT S-2 -	S/36

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TECHNICAL TOPICS

by

R.H. WARRING

THE main topic this month has been a query raised by a number of fellows in Leeds concerning the ultimate speed of a body dropped from a great height. This, of course, brings in the question of Terminal Velocity, a subject that has received a considerable amount of mis-treatment at the hands of the "semi-technical" press.

To commence with, consider a body falling freely in a vacuum. Its velocity is zero at the moment of release, but it will then immediately begin to accelerate under the pull of gravity and its velocity will increase according to the simple formula :—

$$V = gt = \sqrt{2gh}$$

Thus, in this case, the velocity will continue to increase uniformly until it reaches the earth's surface or a position of zero potential energy.

Now consider the effect of air resistance. Drag, we know, is proportional to the *square* of the velocity and will thus have a considerable bearing upon the ultimate result. As our velocity increases under the gravitational acceleration so also does the drag, but even more rapidly. To consider this mathematically, we must take the *forces* acting on the body.

Firstly, we have the accelerating force due to the earth's pull. This will be equal to the *mass* of the body times the acceleration or since mass is equal to *weight* divided by g (the acceleration due to gravity) we have :—

$$\text{Accelerating force} = \frac{\text{weight}}{g} \times g = \text{weight.}$$

Secondly we have the retarding or *Drag* force which is given by the usual formula :—

$$\text{Drag} = C_d \frac{\rho}{2} S V^2$$

Where Cd is the drag coefficient of the body concerned and S is some characteristic area (surface area in the case of wings) ; ρ is the mass density of the air and V is the velocity.

There will now come a time during the fall of the body when these two forces are equal and the velocity will then remain constant since any further tendency to accelerate is nullified by the drag force also tending to increase. Thus the velocity will remain at this limiting value for the rest of the fall and its value can be found by equating the forces. A particular name is given to this limit and it is known as the *Terminal Velocity*.

$$\text{Terminal Velocity (T.V.)} = \sqrt{\frac{2W}{\rho C_d S}}$$

Even this does not take into consideration all the facts. The density of the air enters into the equation, T.V. being proportional to $\frac{1}{\sqrt{\rho}}$, and this still further complicates the problem. The density of air decreases with altitude and thus the Terminal Velocity at heights will be greater than that near the ground. For example, air at 15,000 feet is only .629 times as dense as air at sea level which means that the Terminal Velocity at 15,000 feet of any particular body will be 1.26 times that of the same body just before it reaches the ground. Thus a body dropped from, say, 20,000 feet may reach its Terminal Velocity at 15,000 feet, but due to the fact than from this height downwards the density of the air is increasing its Terminal Velocity will then decrease or the body will slow up as it nears the ground !

As a point of interest a parachutist who has reached his terminal velocity before opening his 'chute will experience less shock than were he to open it whilst he was still accelerating. The Terminal Velocity of the human body is generally accepted to be about 127 m.p.h., although in a delayed drop a Russian parachutist is reported to have reached a speed of 170 m.p.h. Another figure quoted for a freely falling body at 39,000 feet is 220 m.p.h. slowing up to the first mentioned figure near the ground. With the 'chute open the rate of descent varies from 43 ft. per sec. or 29 m.p.h. at 39,000 feet to 23 ft. per sec.or 15.5 m.p.h. near the ground.

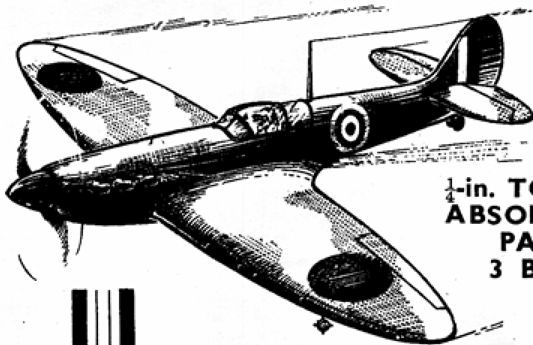
Next we have a question about supercharging small petrol engines. A few American aeromodellers have fitted a "forced draught" to their engines by placing a small funnel in the nose of the fuselage normal to the airstream and connecting this to the induction pipe by rubber tubing. This is reported to have boosted the r.p.m. considerably—and also increased the wear and tear on the engine ! Another method that has been used by the writer in this country is to fit a length of rubber tubing onto the induction pipe and lead this out into the slipstream but pointing "downwind." The exact length must be found by trial and error but once this is found there is a definite 'boost' to the power output. Possibly a better solution would be to shape the induction pipe itself into the form of a venturi, but this demands very careful designing to get best results.

A word of caution about increasing the r.p.m., however. It is extremely useful to get more power from your engine, but a mere increase in the rate of revolution does not necessarily mean that the performance of your model will be bettered proportionally, for with the airscrew rotating at phenomenal speeds there is a danger of this component just "cutting a hole in the air." Whilst it is extremely difficult to generalise on the subject of airscrew design it is possible to say that the quantity V/nD or "J" as it is sometimes called, should not be decreased much below unity or otherwise the maximum efficiency of the airscrew will suffer. The solution here appears to be to increase the diameter and thus absorb the extra power in this manner.

Whilst on the subject of petrol engines a few remarks about the American system of giving the capacity would not be out of place. They have adopted the scheme of working in cubic inches instead of the cubic centimetre with which we are more familiar and the conversion for comparison purposes sometimes offers difficulties. To change cu. ins. into c.c. multiply by 16.39 ; or to change c.c. into cu. ins. multiply by .061. Thus the displacement of the "Trojan" engine which forms this month's heading as given in the American notation is .152 cu. ins. which equals .152 X 16.39 c.c., i.e. 2.5 cc.

Then we have a query by Mr. Jamieson, of Norwich, who wants to know what is meant by equivalent flat plate drag area. Well, equivalent flat plate drag area, or equivalent drag area as it is usually termed, means the area of a flat plate normal to the airstream which has the same drag as the body under consideration. Since the drag of a flat plate is accurately known, at high Reynolds Numbers at least, it is often convenient to refer all "extra to wing drag" to this in computing parasitic drag.

It is surprising the actual reduction in drag that is afforded by good streamlining. A well streamlined body has an equivalent flat plate area of only 1/25 of the actual cross sectional area of the body. As a simple example, the drag of a penny normal to the airflow is approximately equivalent to that of a well streamlined Wakefield fuselage ! Less streamlined shapes have a proportionally greater equivalent drag area.



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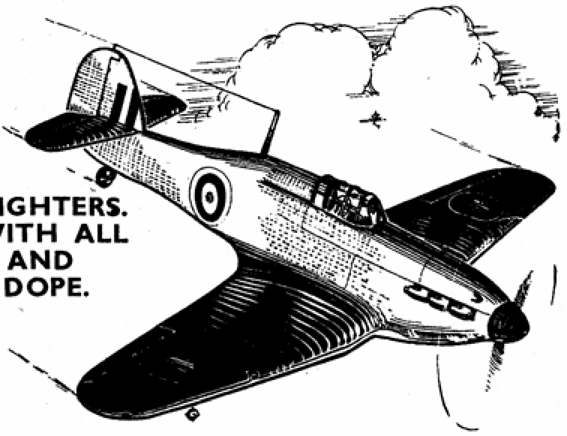

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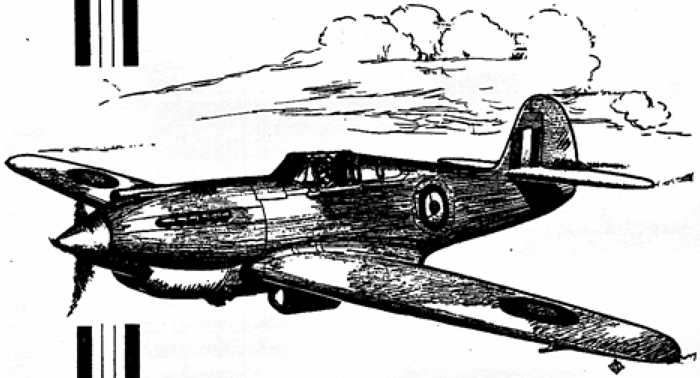

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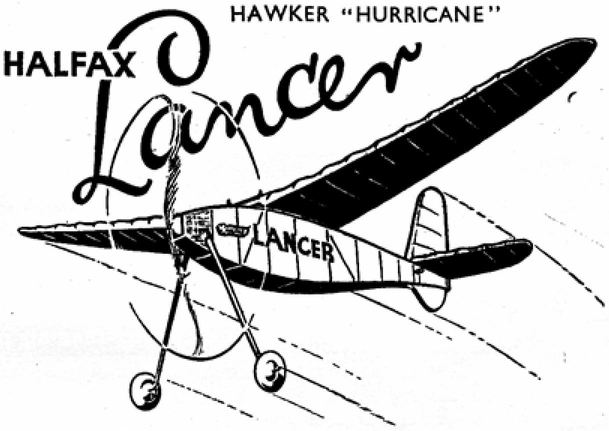

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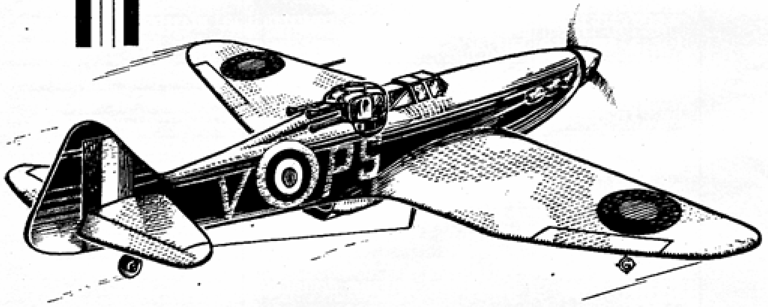

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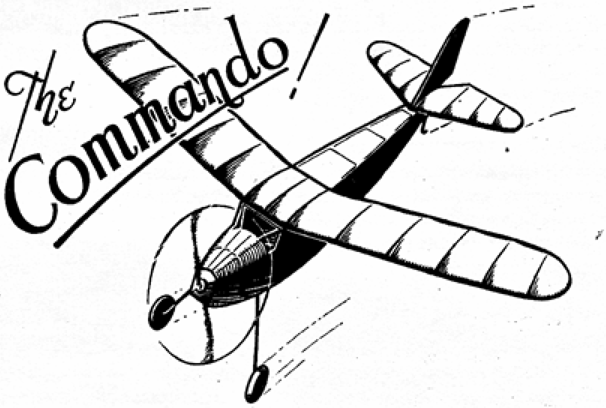

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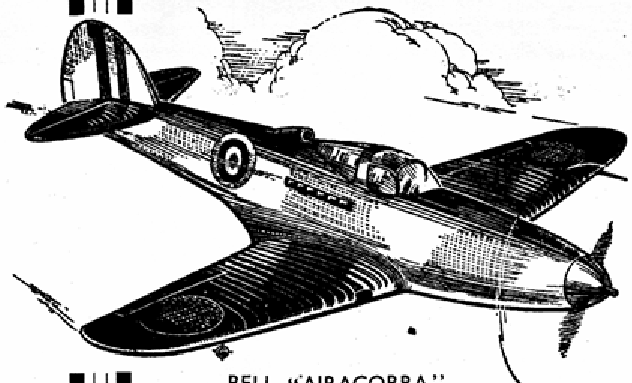

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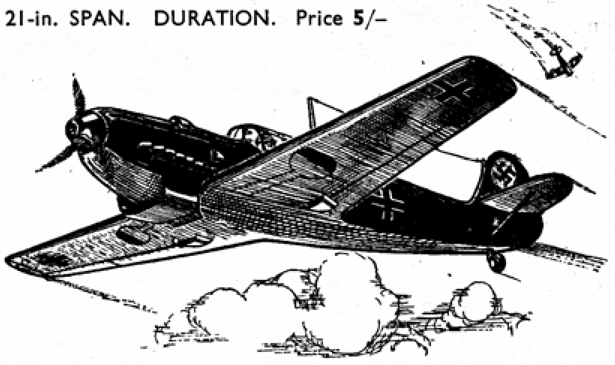

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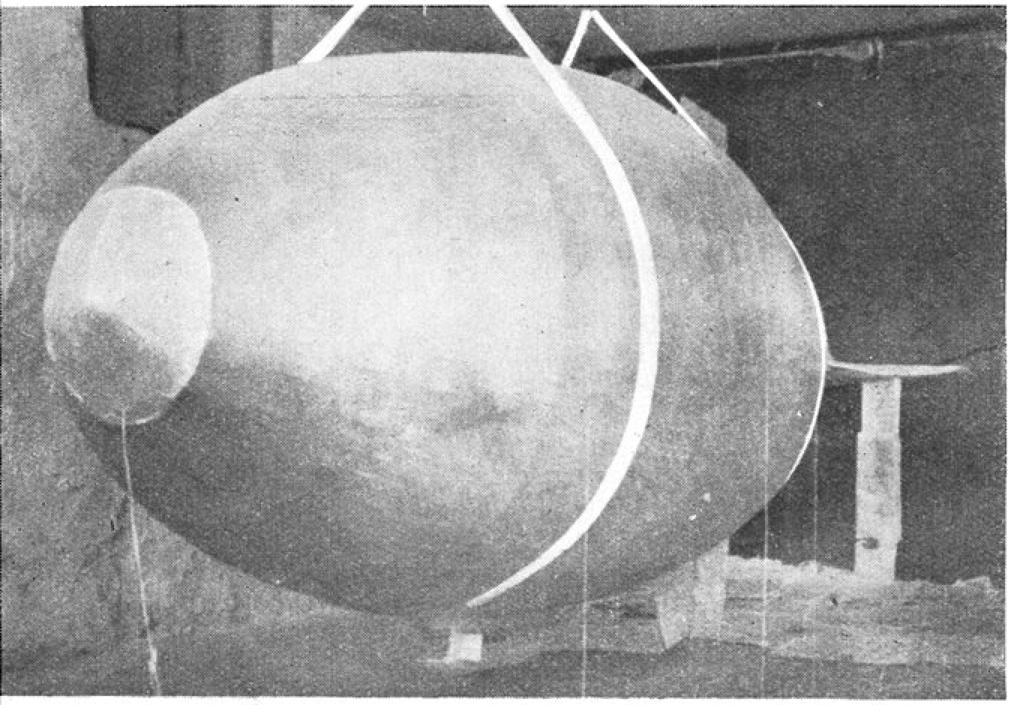


A 10′ MODEL DIRIGIBLE

by Ted Alexander

America's, and probably the world's, first petrol-powered model dirigible, designed and built by Ted Alexander, of Dedham, Massachusetts, U.S.A. A first-class example of painstaking and intricate workmanship spread over three and a half years of spare time, and which is now ready for flight. Whether this will be tethered or free is not yet clear, but details will be published in this journal as soon as they are to hand.

Development.

WITH the development of the lightweight gas engine, a new field of interest and experimentation is open to the model enthusiast—namely, model dirigibles!

The original encouragement of Boston's famed Junior Aviation League seven years ago started extensive research by the writer into the development of lighter-than-air model craft, possibly radio controlled, with the purpose in mind that such experimentation might prove of considerable value to the airship designer and radio engineer alike.

After working on a number of design principals, an original design of unusual strength was developed in 1937 and incorporated into the ZE-1, a rubber-driven model of slightly more than three foot length, weighing 2¼ ounces. This model was given numerous tests for tension, vibration and other stresses.

The results of these tests indicated unusual structural strength in design and it was decided to design and construct a model of even greater size, powered with a gas engine. So, in 1938, the ZE-2 was started, America's first gas model dirigible, a solo project on the part of the writer.

The ZE-2 is ten feet, two inches in length and has a main diameter of four feet and contains (when gas cells are inflated), 36 cu. ft. of lifting gas.

The "Hull."

The ship follows closely in outward form the shape of a Goodyear "blimp," but is completely rigid. The hull is considered of novel construction, internal cross bracing being completely eliminated, such cross bracing having been found to be a needless addition of weight.

Instead, the hull is made up of balsa rings—30 in all, 4 inches apart—making the vertical frame of the ship, which is held together by 172 longitudinal balsa struts running the complete length of the ship.

The rings are made up of section of sheet balsa cut from grained wood and fitted together so that no section of the completed ring is made weak by the running grain of the wood, as would be the result if the ring were cut from one sheet of balsa. The wood for the rings is of 1/16 in. thickness.

The weight of the rings was found to decrease considerably with size rather than increase proportionally as was originally expected. In other words, if a ring of one foot diameter weighed 1¼ ounces, it was expected that a ring of two foot diameter would double or more the weight of the one foot diameter ring. What really happened was that the two foot diameter ring would really only weigh a half-ounce more and have increased displacement, thus greater lift.

Therefore it can readily be seen that the greater the size of the model, the more certain one can be of its successful flight in terms of reduced construction weight, and greater displacement, with increased lift. These factors will, in turn, permit greater power, increased "pay load" in terms of more sensitive and extensive radio control facilities.

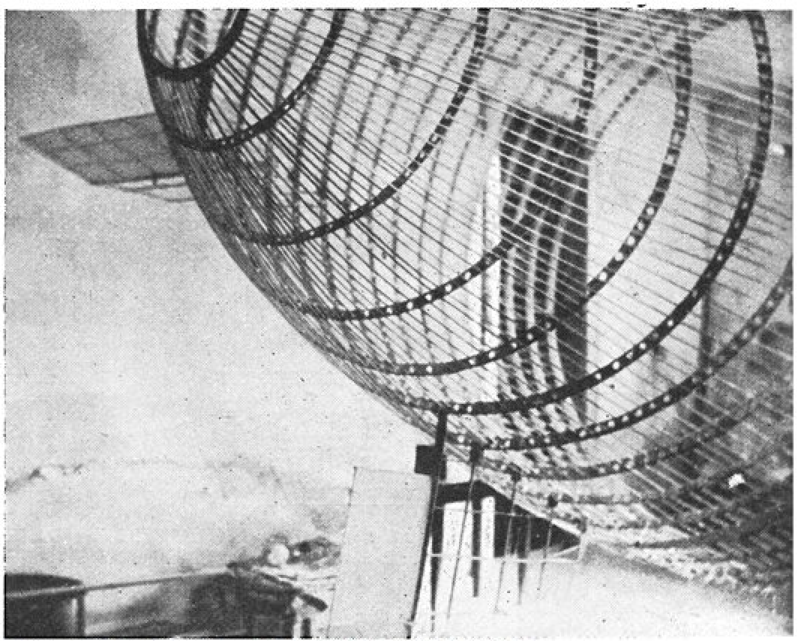
To make the rings even lighter, holes were punched in the flat side of the rings, reducing the total weight by six ounces.

Nose and tail sections were made from a special plastic formula developed for the purpose after it was found that aluminium, originally specified for these units, was too heavy. The plastic units also exceeded specifications slightly, but this addition of weight was removed in other parts of the ship.

Over ten thousand notches, each 1/16 of an inch square, were cut into the rings to fit the longitudinal struts and making for a smooth surface over the entire model. All work was done with razor blades for cutting tools. A special fast drying cement was used in joining struts to the rings as this work had to be done as rapidly as possible and with great accuracy.

It is difficult to describe the amount of work involved, but close examination of photographs will give some indication of the hours of painstaking labour involved. Strength in design is shown by the fact that any section of the ship will support the entire ship with but slight strain being apparent. The hull was made in two sections and then joined, making for greater ease of handling during construction.

The photograph at the top of the page shows a three-quarter front view of the model, completed and covered. Note the handling "cables" attached to the hull and the plastic nose. The lower photograph shows details of the rear hull assembly and the fins.



The Fins

The fin area is somewhat large for a model of this size. This is an experiment to determine if the slight roll associated with full-size airships could be eliminated. Four fins are used, a large master fin top side of ship and a smaller fin supporting the rudder on the underside render stability and control aided by two horizontal fins, one on each side of the hull and of equal size, supporting elevator controls. These fins are streamlined into the hull and are braced with Tungsten wire.

The Gondola

Perhaps the most interesting part of the ship is the gondola. Completely detailed, it resembles the interior of an actual airship gondola or cabin, with controls and instruments that actually operate the model and direct its flight. From the control " box " run cables up into and through the hull and down into the fins to the control surfaces. These cables run on a special arrangement of pulleys and dural guides. As the control wheels are turned back and forth to move elevators and rudder, tiny dials signal the direction and lift, operating directly from the control surfaces. Ballast toggles hang by the sides of the walls and dump sand when pulled. For the comfort of a Lilliputian crew, there are tiny leather chairs and even a desk for the navigator. Doors and windows open and shut, sliding back and forth on tiny slides and hinges. There is even a special instrument panel (that actually works !) for the motor alone.

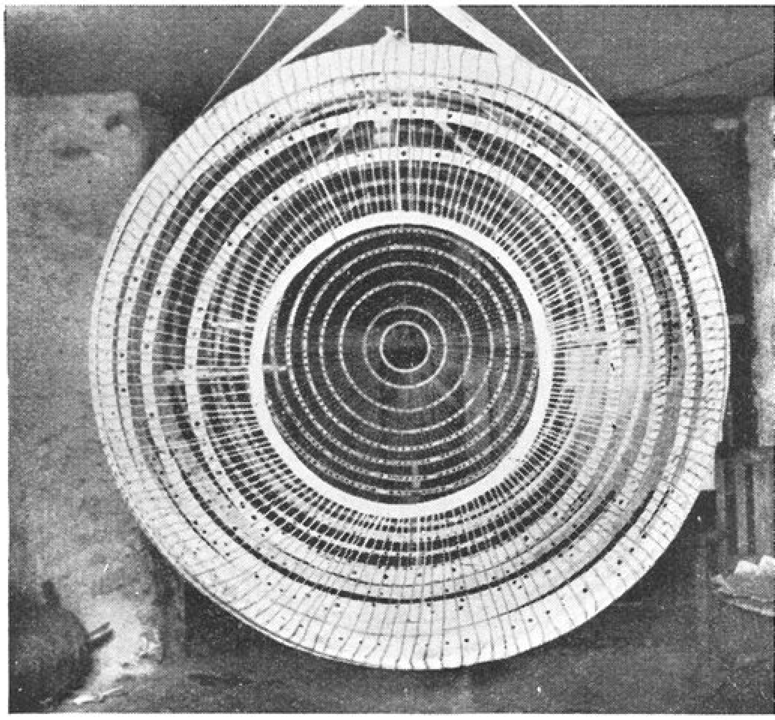
The gondola supports the motor on dural outrigging. The motor is a small lightweight of the Class A type with a displacement of .097 cu. inches, driving an eleven-inch adjustable pitch propeller creating power sufficient for this type of model.

Other Features

Weight is the most important consideration in the design and construction of this type model aircraft. An airplane, being heavier than air, is naturally dependent upon powerful motors for lift. The airship, being lighter than air, depends only on its motors for direction. Should engine failure develop, unlike the airplane, the airship will continue to float. Weight in an airship model must be kept at a minimum in order to get the amount of lift from the gas. Therefore a lightweight motor of low power can be most successful. Total weight of the ZE-2 is only thirty-eight ounces !

The lifting gas for the ship is contained in three Durex balloons of the type used by the U.S. Weather Bureau. These will be inflated through hatches built into the hull that completely enclose the appendices of the balloons within the ship.

An important factor to consider is pressure. With various changes of pressure within the ship brought about by temperature and altitude changes, as well as ballast loading, it is natural to expect expansion or contraction of the balloons. To prevent the varying tensions on the hull from this changing pressure (which might cause total collapse of the frame), ten automatic air ventilators will be installed in the envelope to control pressure. While these ventilators only weigh ⅛ of an ounce for the ten, it is expected that they can expel or suck in—as the need be—three cubic feet of air per minute, or what is believed sufficient for any normal change.



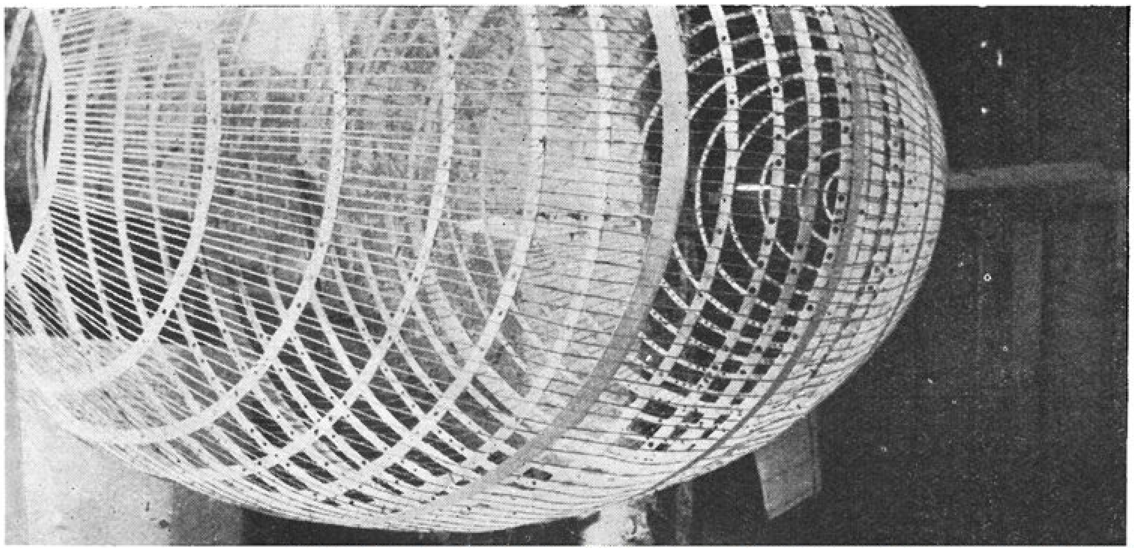
The model has been covered and doped. Japanese tissue (AA quality) was used for the purpose except for areas subjected to the most strain and these are covered with bamboo paper. This covering has been doped three times, with a final application of silver dope. The silver dope prevents sudden expansion of the lifting gas by reflecting sunlight. Ultra-violet rays, detrimental to airship operation—and you will understand that this model is really a working model of an airship—have been subdued by a process suitable for models that was developed after research by the writer.

Three and one-half years of spare time work—more than seven hundred hours—will have been spent on the model when the first trial flights are made shortly. Already a six-man ground crew is being trained in the proper handling and transportation of such a large and unusual model, which has been granted the licence AMA-5996 by the Academy of Model Aeronautics as the first official licensed gas model dirigible in America, if not the entire world.

While the writer is naturally proud of this model, new horizons beckon with visions of a far larger model powered with twin motors and operated by radio control . . . but that, like the results of the ZE-2 trials, is another story !

Main details.

Length of hull : **10** ft. **2** ins.
Maximum diameter : **4** ft.
Length of gondola : **1** ft. **6** ins.
Width of gondola : **3** ins.
Power : ⅝ bore, ·097 cu. ins. two stroke, weight **10** ounces complete with coil, condenser and batteries.
Weight : **36** ounces approximately.



The photograph in the top right-hand corner of this page shows a head-on view of the uncovered hull. An idea can be gained from this of the amount of work involved in the notching of the 172 stringers into the 30 rings or formers. No internal bracing is used. The lower photograph opposite shows a close-up of the hull itself with the gondola just visible beneath. The plastic nose is not fitted in either of these photos. Construction is of balsa throughout.

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ANCILLARY DRIVES *by* H. J. TOWNER

The Case for Twin Propellers.

IN the February issue of the AERO-MODELLER, Mr. S. M. Aufrey raises the subject of flexible drives in his article on "Twin Drive Discussion."

As this problem offers so much scope for ingenuity and design I feel I should like to follow it up with ideas and results of experiments I have from time to time carried out.

Aero-modelling, like everything else, is more or less subject to fashion, and this has led to the state of a "One-track mind," or, being interpreted, a "One-prop. mind."

In the early days when there was no fixed idea on the layout of aircraft, full size or otherwise, the twin pusher became very popular and duration was of a high order.

Frank Taic in his Year Book, 1935–36, gives plans for a Class "C" twin pusher designed by Cail Schmaedig of New York, and states duration of 45 minutes plus, and the absolute British record was held by Mr. C. Hersom in 1921–22 with a twin "A" frame pusher R.O.G. 247 secs. It therefore cannot be the fault of twin propellers but the desire to wrap the motor in a fuselage that has brought about the present trend.

The Wakefield formula does allow for more than one fuselage in that the total cross-sectional area must not be less than that of the one. Perhaps the dislike of multi fuselages arises from the fact that owing to their small diameter where each fuselage emerges from the trailing edge of the wing, they are particularly vulnerable at this point.

When a final drive in the form of a propeller is broken up into more than one prop. a different set of problems arise, and without mathematical calculations the position is this :—

A propeller is a mechanism for transforming energy stored in the rubber motor into a thrust which will drive the model forward.

Now this thrust has to be governed in such a way that we do not get too much all at once, or not enough during a long motor run.

In other words there is a definite relation between our motor and our propeller.

Let us take an imaginary case of a single engine scale or semi-scale model with a span of around 30 in. and all up weight of about 4½ ounces.

We know by experience that the following combination is satisfactory :—

10 in. propeller, 13 in. theoretical pitch with a blade area of 10 sq. in. driven by 8 strands of 3/16 in. rubber 20 in. long, and with 600 turns will give us a power run of about 20 secs.

Now what sizes of propellers shall we require if we substitute two for the one propeller on the above model, ignoring friction losses due to power transmission, to get the same results.

Obviously they must each be smaller, but how much smaller ?

We must have some sort of a yard-stick to measure these different size propellers, and I suggest that the different columns of air swept back per revolution is a fair comparison.

But as this is very involved, bringing in volutes and spirals, etc., I propose to simplify the whole thing and represent the column of air by the blade area × actual pitch. In practice, this appears to work out quite well, at any rate on props. of 12 in. and under. Remember, we are only comparing and not computing the work done.

If our 10 in. prop. has an actual pitch of 10 in. and a 10 sq. in. blade area, then 10 sq. in. $\times 10 = 100$ cu. in. per revolution will represent our column of air.

We therefore want our two combined props. to give us a column of air of 100 cu. in. in the same given time as our single prop. job, to get the same performance, that is 50 cu. in. each.

Now two 7 in. dia. props. with a blade area of 7 sq. in. and an actual pitch of 7 in. will give us our column of air of 49 cu. in. each. But these props. will only travel forward 7 in. up against 10 in. of the single prop.

Therefore we must increase our actual pitch to 10 in. and decrease our blade area to 5 sq. in.

Similarly, two 5 in. props. will give a column of air of 25 cu. in. each, with a 5 sq. in. blade area and a 5 in. pitch. But by stepping up the revs. of this size 1–2 the correct volume of air is moved backwards at the correct speed without altering either the pitch or the blade area.

You will be surprised how efficient these little fellows can be made, and the reduction in weight is a great point because the motor nacelles are going to add weight to your model anyway.

How are we going to step these little chaps up ?

Fortunately for us gears will not be necessary, because the smaller blade area will automatically step them up, and it is just a question of rubber to determine the correct speed.

On the single prop. example we used a 20 in. long motor made up of 8 3/16 in. strands giving us a possible 600 turns, but by dividing our single motor into two separate motors, one for each prop., 20 in. long and using 4 3/16 in. strands each, we shall then have a possible 820 turns.

No. of strands ..	4	6	8	10	12	14	16	18	20
3/16 in. ..	42	36	30	27	25	23	21	20	19
¼ in. ..	38	32	28	25	23	21	17	16	15

which takes care of the faster revving props. and in practice this works very well and is far superior to gears with step-up ratios with their consequent liability to fracture and excessive friction at the higher speeds.

On the other hand, if we elect to use the two 7 in. dia. props. with a pitch of 10 in. and a blade area of 5 sq. in. no step up or speeding up is required, and we can therefore use the 820 turns available as compared with only 600 on the single prop.

This only applies, however, where each prop. has its own motor. In other words, we gain all the advantages of gears—longer run, more even torque spread over a longer period—without the disadvantages of friction, etc.

Disposition of Motors.

The difficulty arises in getting two reasonable length motors into a fuselage, but by radiating them outwards from a rear hook more or less centrally placed just behind the trailing edge of the wing where it fairs into the fuselage the difficulty is largely overcome.

I will agree, however, that the overall length of each motor may be shorter than a motor strung through the fuselage from front to rear, but in the case of our 7 in. props. they will only require a motor 14.6 in. long compared to 20 in. long of the 10 in. single prop., that is, the ratio of 820 to 600 turns on the rubber.

However, a comparatively longer motor between hooks can be used, because any subsequent bunching of the rubber is more or less evenly distributed around the C. of G whereas a strung-through motor is not so good in this respect.

The fact, too, that the rear hook is somewhere around the trailing edge keeps sufficient weight off the tail that very little (if any) extra weight is needed to bring the C. of G. into its place, particularly on a scale job.

As this keeps the wing loading down considerably it offsets any advantage that a strung-through motor may have with regard to length.

Still more so is this the case with a four-engined job where we get twice the length of motor run than we should if all four skeins were made into one.

This advantage, however, is somewhat reduced with four props. by the fact that the outboard motors must not exceed 1⅓ in length the distance between hooks, otherwise uneven bunching of the rubber may make one outer wing panel heavier than the other, with dire results, because in general the props. are well out on the wings.

Anyway, in a scale model I do not think that duration is of prime importance. The scale "looks" is the first requisite, with a realistic flight as a very close second, and as my Airspeed Oxford with its angular drive has a power run of 35 secs., I think this fits into the formula very well.

Flexible Drive.

On this type of angular drive a flexible device is advantageous in the nacelles to convert the angular into a forward drive, although it is not always necessary, depending upon the number of strands and the acuteness of the angle.

Up to six strands of 3/16 in. and an angle not exceeding 33°, no flex is necessary, as the rubber itself will do the trick provided the hook is circular in shape and only just large enough to accommodate the rubber so that no bumping occurs.

However, where the design permits of a light load per propeller, such as in a four-engined craft, and the prop. shaft can be as light as 20–22 g, so that they will flex slightly when driving, then an angle as high as 45° can be successfully used on the rubber; but this angle is about the maximum possible without the motor slowing up very considerably and running jerkily.

Flexible shafts are very useful in awkward corners and are probably the most efficient form of drive within certain limitations.

22 g. steel wire wound into a spiral with an outside diameter of ⅛ in. is quite good for the size of motor used on twin-engine jobs where the prop. dia. does not exceed 9 in. and the rubber motor no greater than 6 strands ¼ in. per prop., such as is used in the flexible shafts in the cowlings of the Airspeed Oxford.

Length of spiral plays an important part, and if too long a serious whip occurs which can introduce an entire loop into the drive, although even this will come out as the power dies away.

In general, it is not advisable to use more than 1¾ in. of spiral between bearings unless a heavier gauge is used, such as expanding curtain rod, when 3 in. can be used between bearings with a minimum radius of 2 in.

Naturally the larger the radius the sweeter the drive, but unsupported parts have to be considered.

On the other hand, a spiral can be as small as 1/16 in. outside diameter, revolving in a brass tube the whole of its length with surprising little friction if well lubricated (my old friend Mr. C. R. Rippon put me on to this), and on small jobs it is ideal; but with heavy motors it is apt to fracture between the end of the brass tube and the driving shaft, although a machine made job with a suitable collet might be a lot better. One has to be very careful in bending the tube, as the slightest suspicion of a kink upsets the whole thing.

If the spiral drive is used on heavy motors, i.e. upwards of 12 strands ¼ in. rubber, some sort of brake arrangement must be inserted between the rubber and the flexible shaft if the motor is wound via the propeller, because in winding the spiral will tend to tighten itself up in one direction. This tension must be released before the power tends to twist the spiral in the other direction during flight.

The spiral can be soldered to the shaft quite all right if a little trouble is taken.

Thoroughly clean and tin the outside and inside of the spiral for about ⅜ in. of its length; take plenty of time over this as it's important. Then supposing a 16 g. shaft is being used, thoroughly tin this and solder a sleeve of brass over it—a short length of brass tube to nicely fit into the spiral will do—and sweat all together. It may not run exactly true, but get it the best you can, because after power has been on the spiral will probably take a permanent set anyway.

Making the Spiral.

To make a spiral the simplest way is to mount a suitable length of straight steel wire, say 16 g., in a drill or brace. This wire will be the former upon which the spiral will be made. A ¼ in. of the 22 g. wire is also inserted in the chuck parallel to the former and then bent at right angles where it emerges from the chuck. Now by slowly turning the drill and holding the 22 g. between your fingers (it may get very hot), wind on a few more turns than are necessary.

To prevent burning your fingers let the wire slide through a piece of wood with a hole in it.

Remember that after winding the whole spiral will take on a slightly larger outside dia. than when on the former.

It is better to try some odd bits first and get the hang of it.

The Universal Joint.

If the angle of the drive is not to exceed 35°, then a small universal joint is perfectly good and probably better all round than a spring drive, and is quite simple to make and is positive.

The central portion consists of two short lengths of 18 g. tube assuming 18 g. shafts are used, bound together at right angles and soldered. Each shaft terminates in equal size hooks which are slipped through the brass tubes and kept in place by means of the usual washers soldered in place.

The secret is that the hooks must not ride up and down in

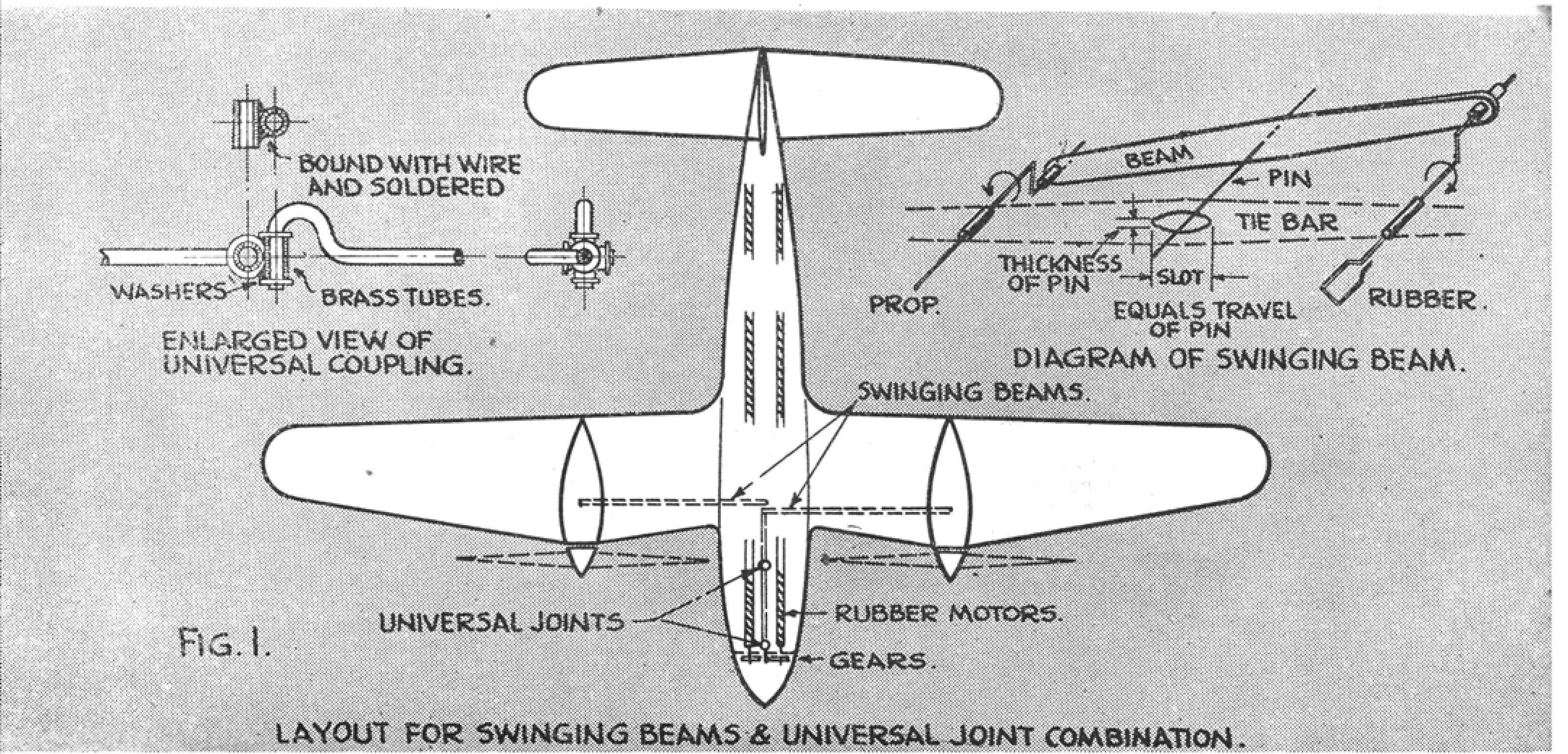


FIG. 1.

LAYOUT FOR SWINGING BEAMS & UNIVERSAL JOINT COMBINATION.

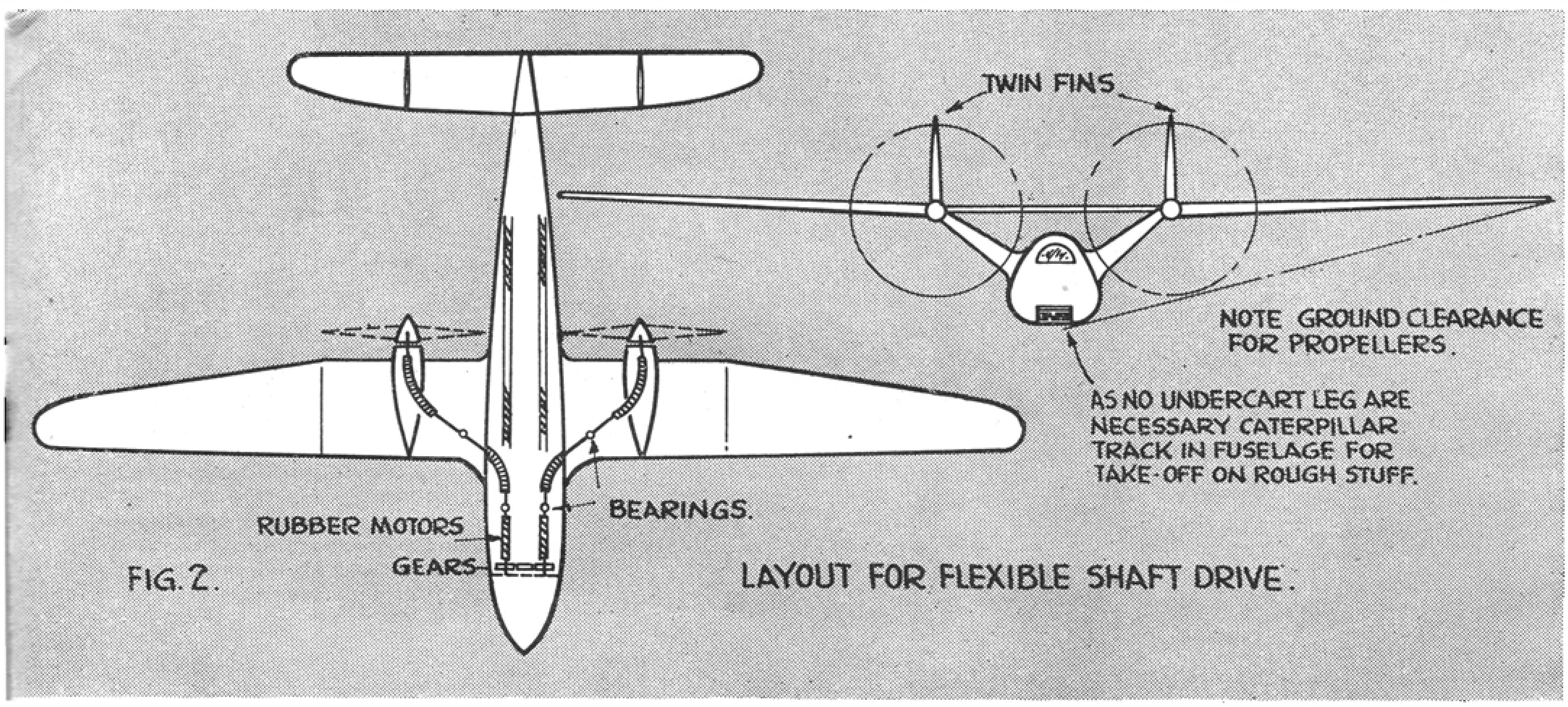

TWIN FINS
NOTE GROUND CLEARANCE FOR PROPELLERS.
AS NO UNDERCART LEG ARE NECESSARY CATERPILLAR TRACK IN FUSELAGE FOR TAKE-OFF ON ROUGH STUFF.
RUBBER MOTORS
BEARINGS.
GEARS

FIG. 2. LAYOUT FOR FLEXIBLE SHAFT DRIVE.

their respective tubes, but when the shafts are laid out horizontally they shall both be in line with one another. It is as well to keep their respective bushes or bearings about an inch away from the coupling, so that the protruding shafts have a chance to smooth out any inaccuracies in the line up.

Crank Drives.

A crank drive is also possible, but here again it is limited by all sorts of factors.

To take the simplest example, it consists of two cranks connected together with a beam or connecting rod so that the rubber motor will drive one crank and the other crank is connected to the propeller; but in this state it is absolutely useless, as it is very jerky on dead centres and is always tending to reverse its motion.

Three cranks with the rubber motor driving the central crank is just as bad; but four cranks with either one in the centre being the driver and the other crank an idler, or both central cranks driving is not so bad, but the chief disadvantage is the unbalanced mass of the connecting rod.

On the other hand, a pair of double-throw cranks with one pair set at 90° to the other as in locomotive practice is quite good; but still there is an unbalanced couple unless two sets are used, one for the R.H. and the other for the L.H. prop.

In each case, however, the props. both turn the same way unless two separate driving shafts are used, but geared together. Although as I have said elsewhere, the torques on twin-engine jobs are not troublesome, and it is far easier to match two props. of the same hand than two opposing props.

The greatest drawback to this kind of drive is the fact that the cranks must be exact pairs and that the centres of the shafts must remain accurate, otherwise a lot of binding will occur.

Anyway, the two-throw crank is too tricky to line up that it is not worth wasting time over, as there is another type of crank drive that appears to fulfil all our requirements apart from a little patience in assembly.

Only two cranks are necessary, one for the rubber and the other for the propeller, and each crank is connected together with a beam or connecting rod in the usual way, but so arranged that when one crank is up (for a horizontal drive) the other crank is down, so that the beam or link is swinging all the time and actually swings over the dead centres so that in effect there is no dead centre at all.

Now the secret of the mechanism is that a pin is fixed to the centre of the beam and is allowed to travel in a suitable slot which is fixed in the fuselage. The slot is enlarged during the greater part of its length so that the pin is not in contact with it except at its ends, where the slot is closed in to form guides for the pin during its change of motion, and thus prevents any tendency of reversal on the beam itself.

There is, of course, a slightly unbalanced couple due to the mass of the beam on a single-engine job, but a pair of such units for a twin prop. drive will balance out provided the cranks are set at 180°.

The friction is negligible, and I've had a 10 in. prop. "revving" up to nearly 2,000 per min. without any trouble, using 18 g. shafts and cranks.

The cranks, of course, must exactly match, and the easiest way is to solder both shafts together and then bend into the form of the cranks, unsoldering again afterwards.

The shaft centres must remain constant and so a compression strut carrying the bearings is essential, and it is in this strut that the slot can be made.

The throw of the cranks can be $\frac{3}{8}$ in. with a beam of $\frac{3}{8}$ in. at its ends, increasing to $\frac{1}{2}$ in. at its centre. The beam itself can be built up into a hollow box of 1 millimetre ply sides joined together by $\frac{1}{8}$ in. sq. balsa top and bottom, and suitable distance pieces where the bushes and the fixed pin are inserted.

The compression strut, or more accurately tie bar, can be made of $\frac{1}{8}$ in. ply or built up similar to the beam with hardwood guides for the pin either end of the slot.

In a twin motor layout this tie beam would form the main spar of the centre section.

Conclusions.

To sum up, then, I would say it is far better to dispense with any form of mechanical power transmission if at all possible, but where a remote drive is necessary, then a universal coupling on a shaft drive provided the angles do not exceed 35° is the most efficient, and it is positive.

Spring drive, on the other hand, is quite good, but the friction in the bearings is greater, and also it has to be carefully treated where heavy motors are concerned.

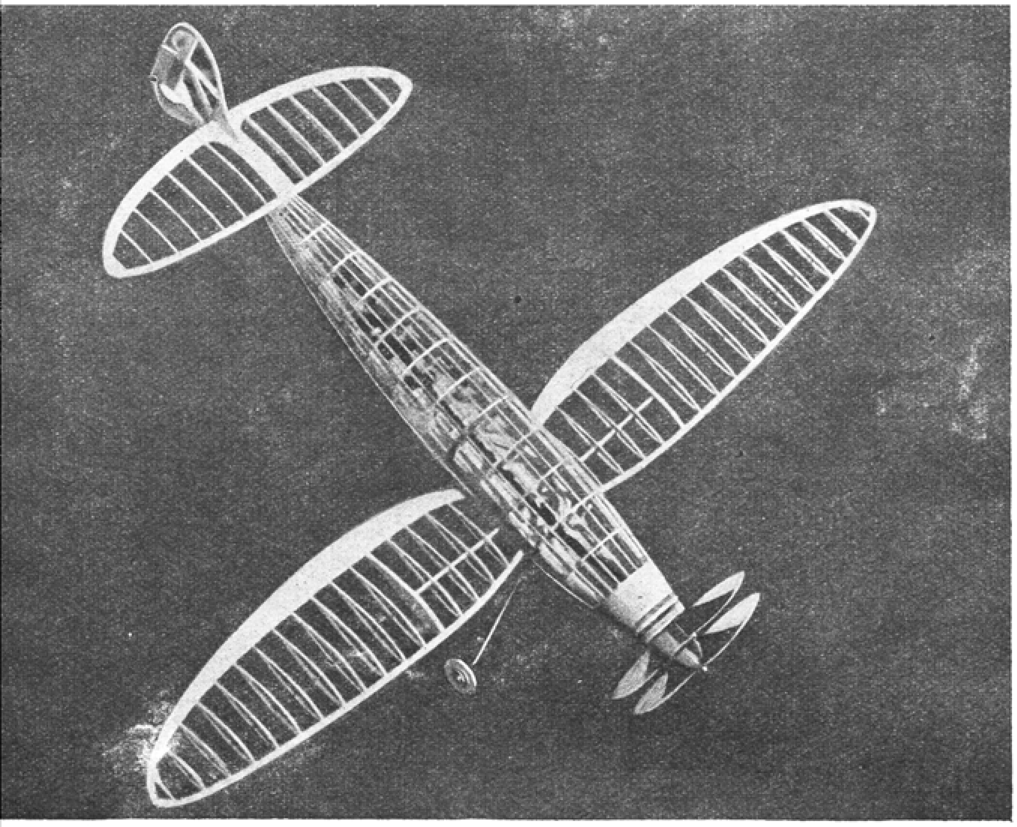
The swinging beam is very effective and is also positive, and will handle heavy loads, but patience is required in the assembly.

Of course, a combination of any or all three methods can be used with advantage, and most layouts would require the use of gears. Provided the gears are a good fit on the shafts and the hole well tinned and the shafts tinned as well, and all sweated together, there is no need for slipping to occur.

The system I always use for bushes and gears is to use a shaft a shade larger than the hole. Carefully fill or grind four sides to an odd piece of shaft to form a reamer, and then carefully reamer out the bushes and gears. Then with a little running in they make a perfect fit without any slap or hammering and always run true.

Note: For the benefit of Mr. Aufrey the Spencer Larsen drive was tried with a floating shaft to eliminate binding in two widely spaced bearings and to take care of any set in the spiral spring. However, when I began using heavier motors I did away with the floating drive as shown in the plan of the Aero-Modeller Plan Service.

Full size working drawings of the Spencer Larsen are available through the Aeromodeller Plans Service, price 6/– post free.



CO-AXIAL

by C. F. HEDGES

One of the neatest co-axial propeller designs that we have yet seen which will, no doubt, be welcomed by the serious aeromodeller. The actual gearing is a little intricate but should present no especial difficulties to the model engineer. The photographs show the excellent form of construction used and the pleasing lines of the finished machine.

BEFORE commencing the instructions I would advise anyone about to build this model to obtain the best quality material in order to obviate any weak spots. As will be noticed, weight has been cut down where possible in order to allow for places which need extra strength. On the original model the props and mechanism worked out lighter than was expected and this necessitated the addition of a slight weight on the nose in order to balance the model, but including this extra weight the finished model, with 1 oz. of rubber, weighs only 5½ oz., which, you must admit, is not bad for a job with two props and gears.

To get to the building, we will commence with the fuselage.

FUSELAGE

If you have built a circular fuselage before, no difficulty should be found. The first thing is to cut out the formers as shown on the plan, using two laminations of $\frac{1}{32}$ in. sheet, marking for stringer positions and longeron slots using the " master " diagram. Former No. 4 (three-ply) is for strength in order that the fuselage will not collapse when the wing fixture is cut away. Former No. 11 (three-ply) is for the rubber fixture and rudder control attachment. This fitting should be made as shown on the plan and fitted before the fuselage is assembled, if it is left till later it will be found very difficult to fix. It will be noticed that two springs are specified, one on each side of the fitting, this is in order that an even pull will be obtained. The little balsa block is to prevent the fitting jamming when the rubber is wound tight. The nose former is made as shown with laminated balsa and face and back of three-ply, and also the nose block, which should be made a tight fit, for the present, and placed in position. The four main longerons should be steam bent to shape and the top and bottom ones cemented together at the back as shown, and also into the slots on the nose former. Put formers in next, then the other two longerons.

If a pin is stuck in the centre of the nose block and one in the back end of the longerons, the fuselage may be " spun " round in order to test its accuracy.

The next job is to fit the undercarriage. Bend the 16 s.w.g. wire in a circle to fit around former No. 3 and to come out of the fuselage where shown at " A." Bind the wire to this former and coat with cement. The stringers can now be cemented in place, putting them on first at one side and then at the other in order to obviate the possibility of pulling the fuselage out of true. Fill in between longerons and stringers with $\frac{1}{16}$ in. sheet where shown, not forgetting the portion for the " inspection door " and the portion at the rear.

When completed, cut out for the wing attachment along line marked " L." Retain the portion cut out, which will form the wing centre-section. Now cement $\frac{1}{16}$ in. sheet across the opening in the fuselage with grain running crosswise, as shown by position between lines " L " and " M." Lay a second covering over the first, but cement very lightly at the edges only. Trim the portion cut away from the fuselage so that it conforms to line " N " and fit back into the opening, cementing to the second $\frac{1}{16}$ in. covering. When dry the light cement fixing may be cut through and the wing will be fitted to this portion. Cut out the centre of both sheets which run across the fuselage (" LM " and " MN ") in order to allow space for the rubber (see sketch on plan). Cut out the " inspection door " as shown.

TAIL PLANE SUPPORT

This can now be fitted. Cut out of $\frac{1}{16}$ in. sheet support F2 as shown on plan, sand the front underside to a curve so that it will lay snugly on the fuselage top, and cement in position. Also cement the back support in place (the one attaching F2 to the back end of the top longeron) and be sure to get it vertical. Now cut out two side pieces of $\frac{1}{32}$ in. sheet as shown and, using plenty of cement, fix these in position.

THE FIN

Built out of $\frac{1}{8}$ in. medium sheet and $\frac{1}{8} \times \frac{1}{8}$ in. strip. $\frac{1}{16} \times \frac{1}{8}$ in. strip is cemented on each side of the $\frac{1}{8}$ in. square, to thicken up the section after removal from the building board. These will cross the upright as at " A." The RUDDER consists of two sides to shape in $\frac{1}{32}$ in. sheet, with spacers and stiffeners as shown in dotted lines, these are $\frac{1}{8} \times \frac{1}{8}$ in. When construction is complete, the rudder is cemented lightly in place and the whole unit sanded to a fair streamline section. The rudder may then be removed and pieces " C " fitted, a cut-out being made in the bottom of the rudder for this. The RUDDER HINGE consists of a strip of cellophane cemented down starboard side only ; covered over with tissue in ordinary manner when covering the rest of the machine. The operation of the rudder is explained on the plan.

THE WING

Great care is required in the construction of the wing on account of its unusual design and special shape, both in plan and front elevation. This latter view is not shown on the plan, as, if the correct method of assembly is carried out, the correct shape is automatically obtained. The ribs are made as shown, by first making a three-ply template to rib No. 6, and with this, cut out from $\frac{1}{16}$ in. sheet thirty upper and thirty lower curves each $\frac{3}{32}$ in. wide. The various ribs are made by trimming these to the required length, cutting off from the trailing edge only. A stay of $\frac{1}{16}$ in. square is cemented in each rib as shown. Nos. 1, 6 and 18 are solid, with slots cut where shown. Each rib is cut for the fitting of leading and trailing edges as shown at No. 6, on the plan of the wing. The angle of the trailing edge to the rib *chord line* must remain

AIRSCREWS

& R. V. BENTLEY

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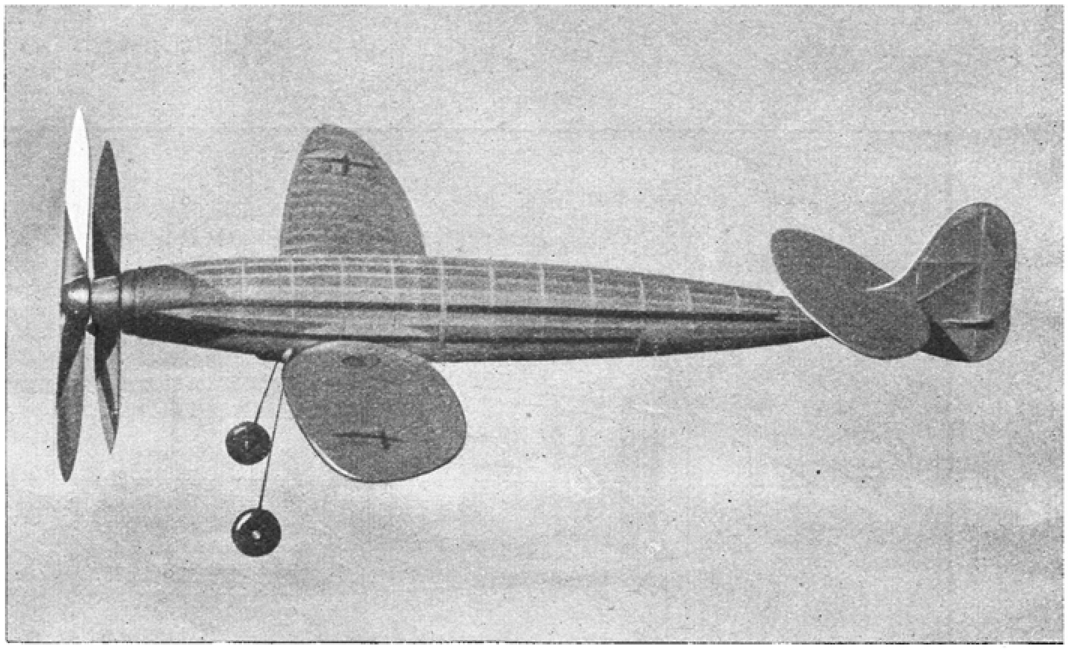


constant for all ribs. The trailing edge is cut from $\frac{1}{16}$ in. hard sheet, while the leading edge is very hard $\frac{3}{16}$ in. square, and must be carefully steam bent to exact shape. The wing is now assembled by marking the rib positions on the leading and trailing edges and pushing on the ribs in their respective positions, cement well. The assembly should be " eyed " from the ends frequently, to ensure a smooth tapering surface without any irregularities.

Note.—The wing cannot be assembled by the usual method of pinning to the plan, owing to the trailing edge having a curve, the lowest part of which is at rib No. 6.

The tip is made from a piece of soft balsa (grain as shown) sanded to shape. Sand the trailing edge off to a nice taper, and round off the leading edge. Don't sand too much off the ribs.

A short spar of $\frac{1}{16} \times \frac{1}{4}$ in. very hard balsa is fitted to reach from rib No. 6 to the centre of the fuselage (cut away portion), slots are provided in ribs 1 and 6 for this. The spar dips to the root of the wing in order to get it as low as possible in the fuselage. The other wing is built just the same in reverse. Be careful to get the curves, etc., on both wings exactly the same.

Leave the ends of the leading edge, trailing edge and spar, and cut to correct length when fitting to centre-section.

TO FIT WINGS

The centre spar passes to the centre of the cut away portion of the fuselage and is glued firmly to the forward side of former No. 4 (bottom section of course). The leading edges are crossed and halved to each other and cemented firmly to the bottom and sides of the centre-section. The trailing edge is cemented and faired to the side of the centre-section (it is not necessary to pass this through the side). Glue the spar in position to get the correct dihedral (3 in. at tips) before cementing the leading and trailing edges. The correct incidence can be obtained by lowering or highering the leading edge, and then cementing in place. Rib No. 1 should come about level with the top sides of the centre section when viewed from above (see diagram). Fair in with plastic balsa, etc., from rib No. 1. Two locating pegs should be fitted to the front and back of this centre-section and slots made in the fuselage to take same. Taper these pegs so that they will slide out of the slots in the fuselage when the wing is pushed backwards or forwards.

THE STABILISER

This is constructed in normal manner. Pack leading and trailing edges for height required at ribs No. 1 and build over plan. No. 8 rib is not slotted, as it is too small, but is cemented on the ends of the leading and trailing edges. Soft balsa tips are used as for the wings. The space between ribs No. 1 is filled in with $\frac{1}{16}$ in. sheet, fitted *between* the ribs both top and bottom. The bottom being later cut out so as to fit on support F2. Four hooks (bent pins) are fitted as shown to take two rubber bands passed round the fuselage to hold the tail in position.

THE PROPS, ETC.

These can be carved from 1 in. square block balsa, but as 1 in. is not wide enough for the " spinners," extra pieces as shown at " H " are cemented on. The shape of the props. is shown on the plan. Trace these on to your block. Don't forget, the front prop is a normal left-hand one and the back one a right-hand.

The nose block can now be made an easy fit, the top (the flat portion) should be bevelled slightly to allow the assembly to " knock out " as a safeguard in the event of a bad landing. The plan will explain the rest of the " workings " better than mere words.

COVERING

Wings should be covered with tissue grain spanwise. Stick the tissue to conform to lower surface curves. Don't cover *too* tightly or you may find that the tissue will pull away from the under camber when it is shrunk and doped. The tail plane can be covered in one piece top and bottom. The fuselage should be covered with strips running from front to back, cut about the width of the space between four stringers, with the grain running *round* the fuselage. If these strips are fastened first to one end, then pulled slightly and fastened to the other end they will curve nicely to the shape of the fuselage, and can then be fastened along the stringers.

THE WHEELS

Wheels of $1\frac{1}{2}$ in. diameter are used, they are not shown on the plan, but are of the streamline type made from laminated balsa. A " bearing " can be made from two small pieces of three-ply or a piece of thick celluloid let in each side and glued. Solder a couple of small washers on the bent ends of the undercarriage legs to retain the wheels.

NOTES

The back rudder springs *must* operate before the front rubber tensioner or the rudder will not come into operation.

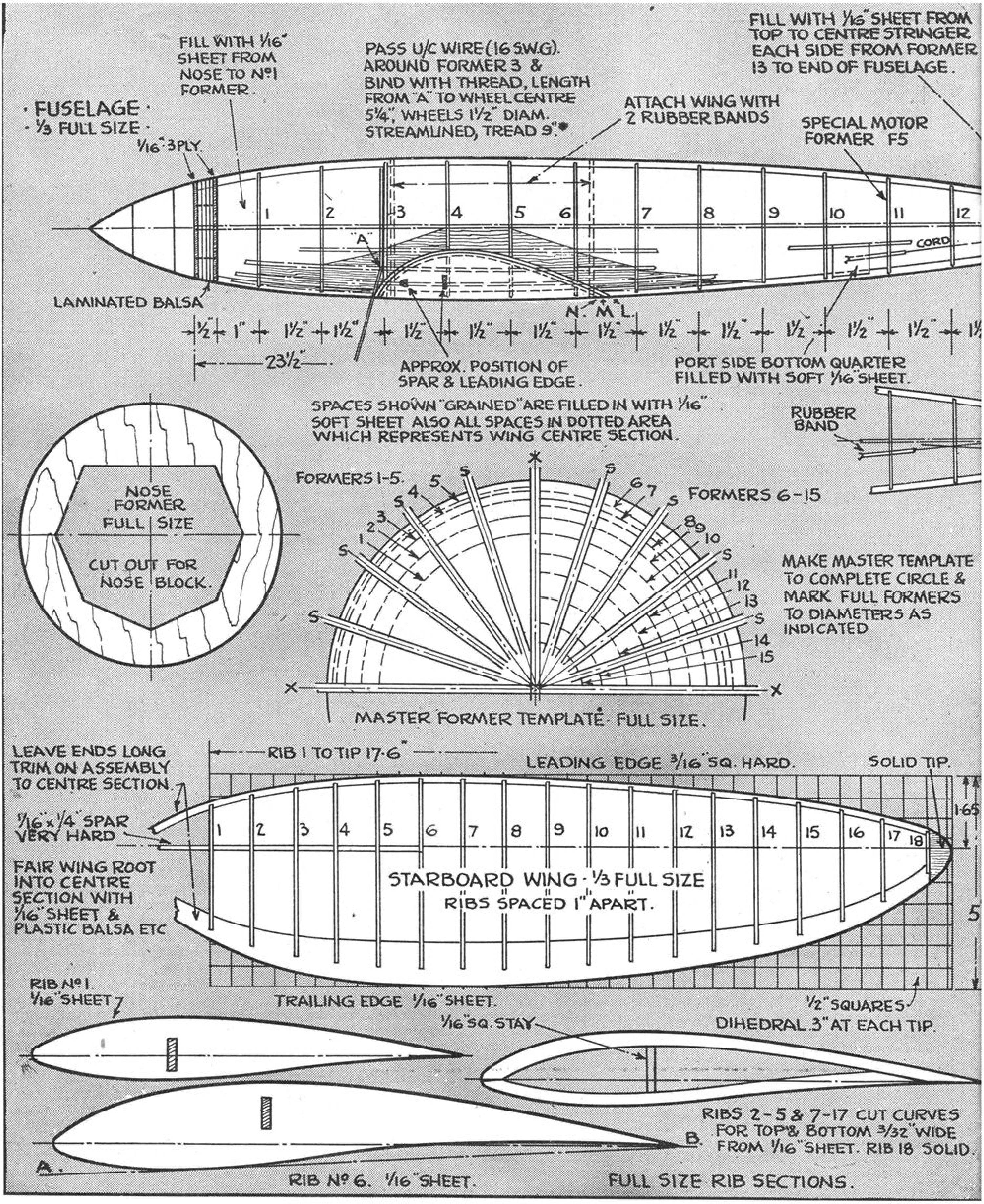
The rudder cord must *not* be glued to the rudder, but just run in the groove, the tension of the rubber band will hold it in place.

See that the rudder is set straight before each flight.

If it is found that the gears are developing too much play, un-solder the front fastening, hold the assembly upright, push the front prop. down and re-solder.

Ordinary balsa cement is not as good as glue for sticking three-ply.

A mixture of cement and dope (not very thick) will be found far better than paste for fixing the tissue.


FUSELAGE
1/3 FULL SIZE
1/16" 3PLY.
FILL WITH 1/16" SHEET FROM NOSE TO Nº1 FORMER.
PASS U/C WIRE (16 S.W.G.) AROUND FORMER 3 & BIND WITH THREAD, LENGTH FROM "A" TO WHEEL CENTRE 5¼", WHEELS 1½" DIAM. STREAMLINED, TREAD 9".
ATTACH WING WITH 2 RUBBER BANDS
FILL WITH 1/16" SHEET FROM TOP TO CENTRE STRINGER EACH SIDE FROM FORMER 13 TO END OF FUSELAGE.
SPECIAL MOTOR FORMER F5
1
2
3
4
5
6
7
8
9
10
11
12
"A"
CORD
N.
M
L.
LAMINATED BALSA
½"
1"
1½"
1½"
1½"
1½"
1½"
1½"
1½"
1½"
1½"
1½"
1½"
1½"
23½"
APPROX. POSITION OF SPAR & LEADING EDGE.
PORT SIDE BOTTOM QUARTER FILLED WITH SOFT 1/16" SHEET.
SPACES SHOWN "GRAINED" ARE FILLED IN WITH 1/16" SOFT SHEET ALSO ALL SPACES IN DOTTED AREA WHICH REPRESENTS WING CENTRE SECTION.
RUBBER BAND
NOSE FORMER FULL SIZE
CUT OUT FOR NOSE BLOCK.
FORMERS 1-5.
FORMERS 6-15
X
S
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
MAKE MASTER TEMPLATE TO COMPLETE CIRCLE & MARK FULL FORMERS TO DIAMETERS AS INDICATED
MASTER FORMER TEMPLATE - FULL SIZE.
LEAVE ENDS LONG TRIM ON ASSEMBLY TO CENTRE SECTION.
RIB 1 TO TIP 17·6"
LEADING EDGE 3/16" SQ. HARD.
SOLID TIP.
1/16" x 1/4" SPAR VERY HARD
FAIR WING ROOT INTO CENTRE SECTION WITH 1/16" SHEET & PLASTIC BALSA ETC
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
1·65
5"
STARBOARD WING - 1/3 FULL SIZE
RIBS SPACED 1" APART.
TRAILING EDGE 1/16" SHEET.
1/2" SQUARES
DIHEDRAL 3" AT EACH TIP.
RIB Nº1. 1/16" SHEET
1/16" SQ. STAY
A.
B.
RIB Nº 6. 1/16" SHEET.
RIBS 2-5 & 7-17 CUT CURVES FOR TOP & BOTTOM 3/32" WIDE FROM 1/16" SHEET. RIB 18 SOLID.
FULL SIZE RIB SECTIONS.

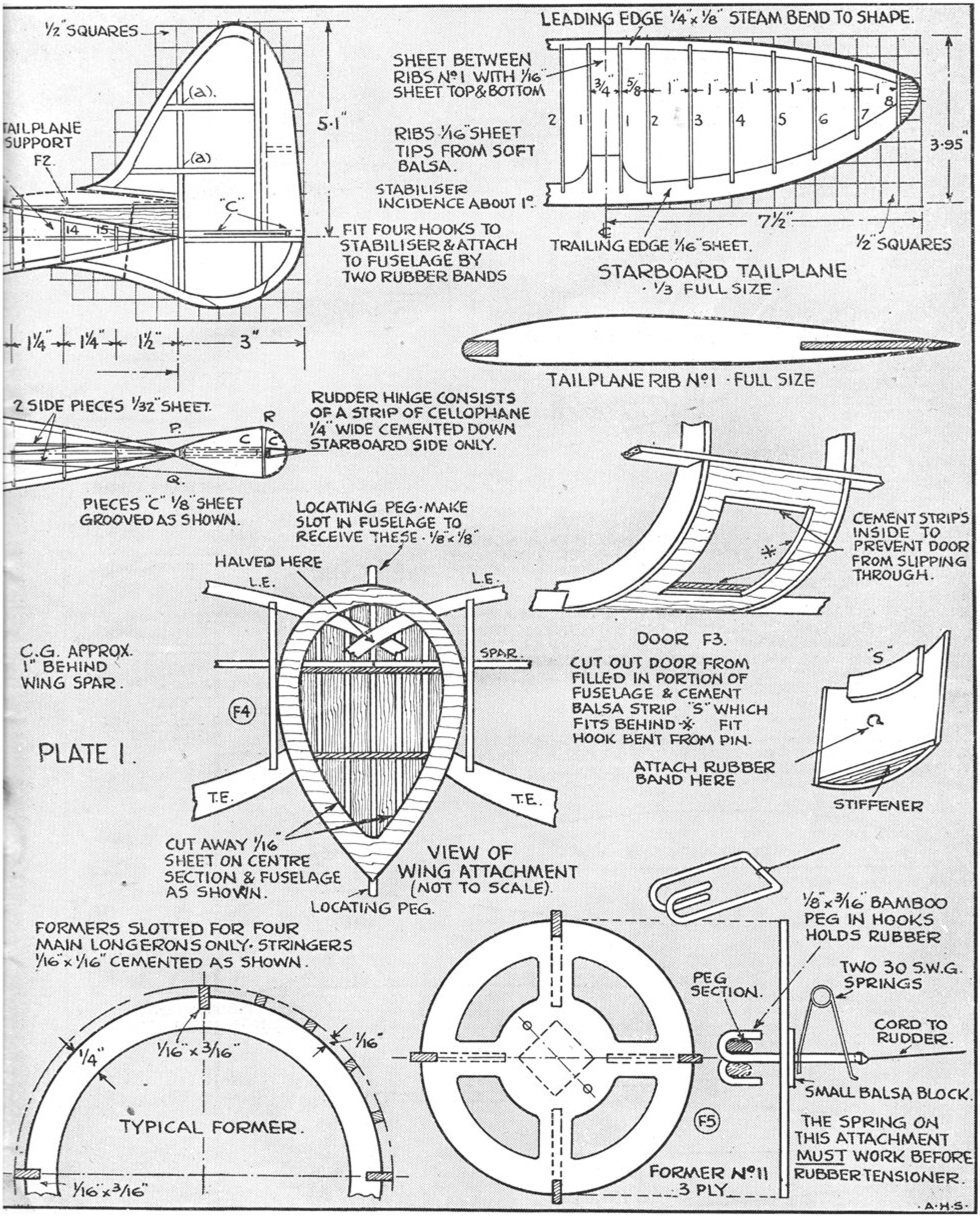
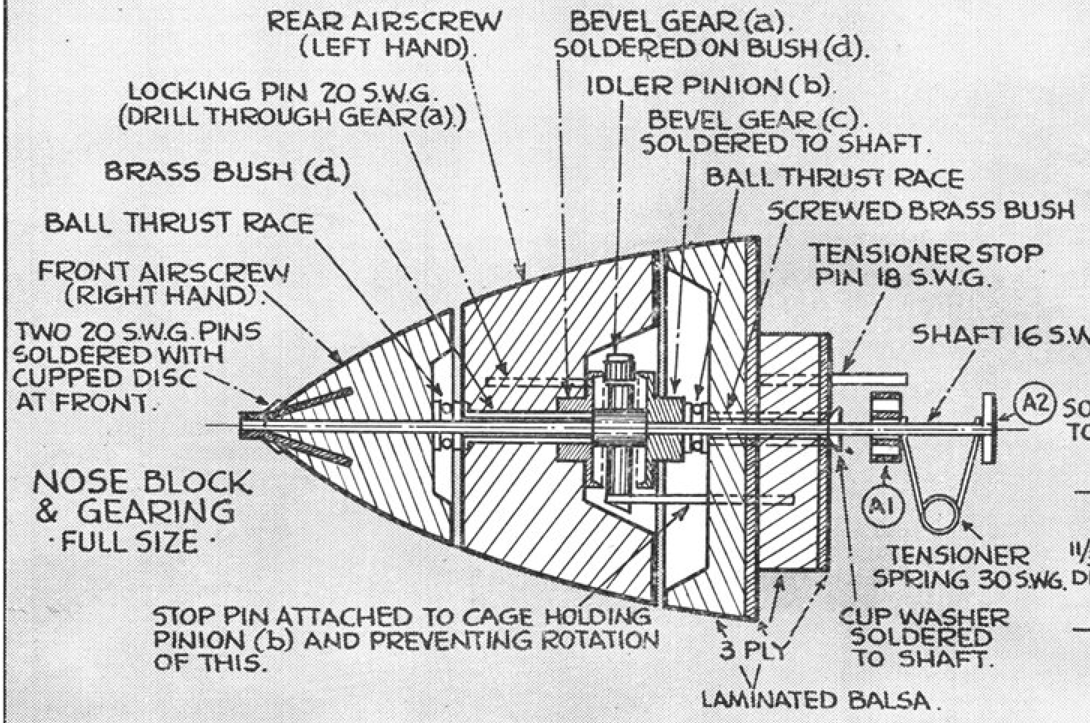
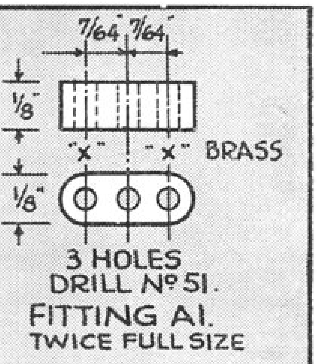

½" SQUARES
TAILPLANE SUPPORT F2.
(a).
(a)
5·1"
"C"
13
14
15
FIT FOUR HOOKS TO STABILISER & ATTACH TO FUSELAGE BY TWO RUBBER BANDS
1¼"
1¼"
1½"
3"
LEADING EDGE ¼" x ⅛" STEAM BEND TO SHAPE.
SHEET BETWEEN RIBS Nº1 WITH 1/16" SHEET TOP & BOTTOM
¾"
⅝"
1"
1"
1"
1"
1"
1"
2
1
1
2
3
4
5
6
7
8
RIBS 1/16" SHEET TIPS FROM SOFT BALSA.
STABILISER INCIDENCE ABOUT 1°.
3·95"
7½"
℄
TRAILING EDGE 1/16" SHEET.
½" SQUARES
STARBOARD TAILPLANE
· ⅓ FULL SIZE ·
TAILPLANE RIB Nº1 · FULL SIZE
2 SIDE PIECES 1/32" SHEET.
R
P.
C
C
Q.
RUDDER HINGE CONSISTS OF A STRIP OF CELLOPHANE ¼" WIDE CEMENTED DOWN STARBOARD SIDE ONLY.
PIECES "C" ⅛" SHEET GROOVED AS SHOWN.
LOCATING PEG · MAKE SLOT IN FUSELAGE TO RECEIVE THESE · ⅛" x ⅛"
HALVED HERE
L.E.
L.E.
SPAR.
C.G. APPROX. 1" BEHIND WING SPAR.
F4
T.E.
T.E.
CUT AWAY 1/16" SHEET ON CENTRE SECTION & FUSELAGE AS SHOWN.
VIEW OF WING ATTACHMENT (NOT TO SCALE).
LOCATING PEG.
CEMENT STRIPS INSIDE TO PREVENT DOOR FROM SLIPPING THROUGH.
✻
DOOR F3.
CUT OUT DOOR FROM FILLED IN PORTION OF FUSELAGE & CEMENT BALSA STRIP "S" WHICH FITS BEHIND ✻ FIT HOOK BENT FROM PIN.
"S"
ATTACH RUBBER BAND HERE
STIFFENER
FORMERS SLOTTED FOR FOUR MAIN LONGERONS ONLY · STRINGERS 1/16" x 1/16" CEMENTED AS SHOWN.
¼"
1/16" x 3/16"
1/16"
TYPICAL FORMER.
1/16" x 3/16"
⅛" x 3/16" BAMBOO PEG IN HOOKS HOLDS RUBBER
PEG SECTION.
TWO 30 S.W.G. SPRINGS
CORD TO RUDDER.
SMALL BALSA BLOCK.
F5
THE SPRING ON THIS ATTACHMENT MUST WORK BEFORE RUBBER TENSIONER.
FORMER Nº11 3 PLY
· A · H · S ·

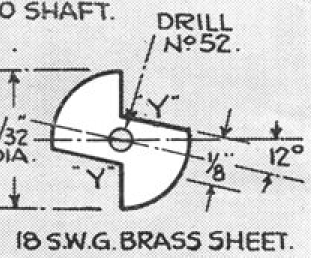
PLATE I.


REAR AIRSCREW (LEFT HAND).
BEVEL GEAR (a). SOLDERED ON BUSH (d).
LOCKING PIN 20 S.W.G. (DRILL THROUGH GEAR (a).)
IDLER PINION (b).
BEVEL GEAR (c). SOLDERED TO SHAFT.
BRASS BUSH (d).
BALL THRUST RACE
BALL THRUST RACE
SCREWED BRASS BUSH
FRONT AIRSCREW (RIGHT HAND).
TENSIONER STOP PIN 18 S.W.G.
TWO 20 S.W.G. PINS SOLDERED WITH CUPPED DISC AT FRONT.
SHAFT 16 S.W.G.
A2 SOLDERED TO SHAFT.
A1
TENSIONER SPRING 30 S.W.G.
STOP PIN ATTACHED TO CAGE HOLDING PINION (b) AND PREVENTING ROTATION OF THIS.
3 PLY
CUP WASHER SOLDERED TO SHAFT.
LAMINATED BALSA.

NOSE BLOCK & GEARING ·FULL SIZE·

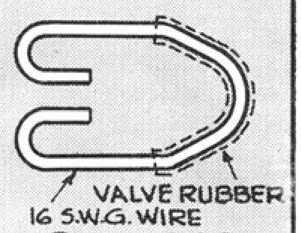


FITTING A1. TWICE FULL SIZE



18 S.W.G. BRASS SHEET.

FITTING A2 TWICE FULL SIZE.



FITTING A3 RUBBER HOOK ACTUAL SIZE.

THE RUBBER IS WOUND BY SPECIAL ATTACHMENT ON WINDER ENGAGING THE FITTING A3 AND THEN CONNECTED TO THE SHAFT BY PASSING THE ENDS INTO HOLES "X" IN THE FITTING A1 COMPRESSING THE TENSIONER SPRING AND ENGAGING THEM IN THE NOTCHES "Y" IN FITTING A2. THE DRIVE IS AS FOLLOWS:– FITTING A3 TURNS THE SHAFT VIA A2, THE SHAFT TURNS THE FRONT AIRSCREW VIA THE TWO SOLDERED PINS AND DISC AND THE GEAR (c). THIS GEAR TURNS THE GEAR (a) IN THE OPPOSITE DIRECTION VIA THE IDLER GEAR ASSEMBLY (b) WHICH CANNOT REVOLVE. GEAR (a) IS PINNED TO THE REAR AIRSCREW WHICH THEREFORE REVOLVES IN THE OPPOSITF DIRECTION TO THE FRONT AIRSCREW.

THE GEAR ON THE ORIGINAL MACHINE WAS A DIFFERENTIAL SALVAGED FROM A SCRAP CLOCK-TYPE D.C. ELECTRIC METER BUT ANY SIMILAR AND SUITABLE SMALL DIFFERENTIAL WILL SERVE.

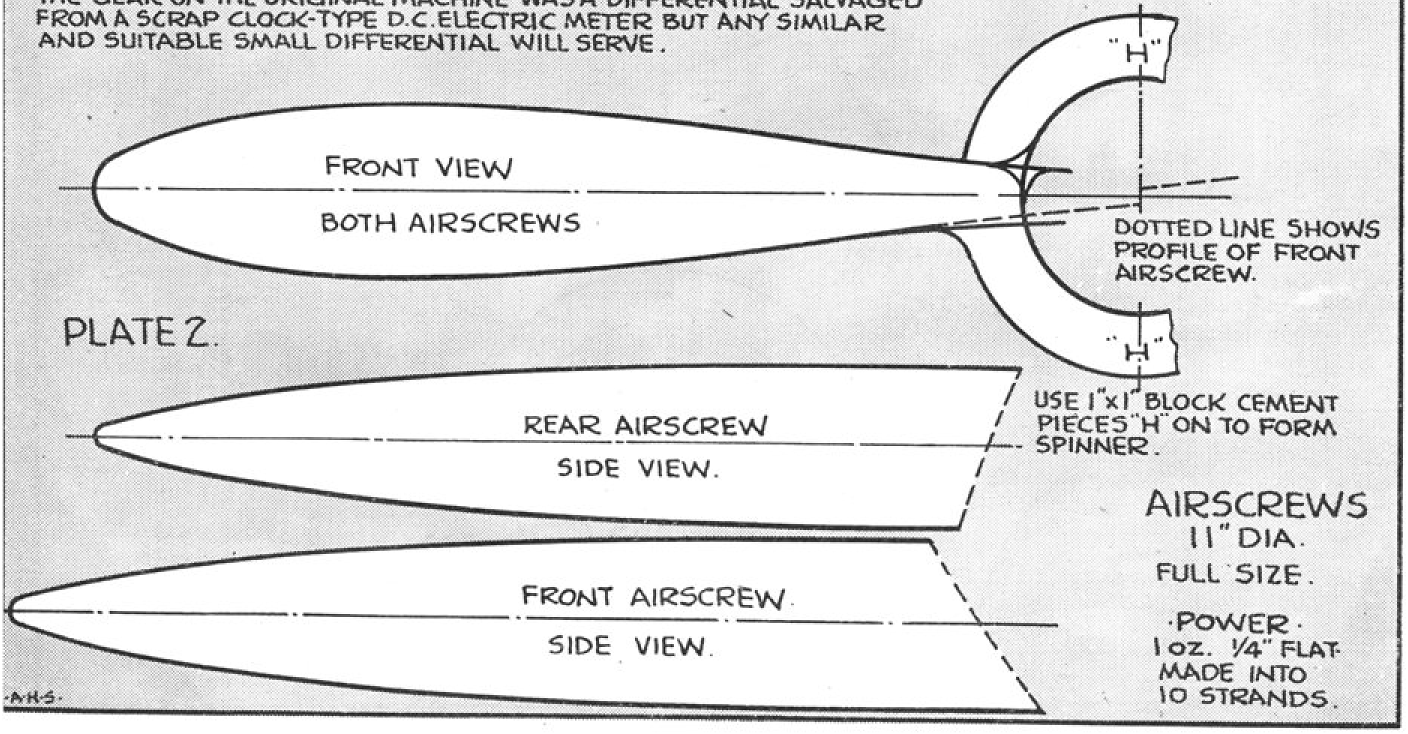
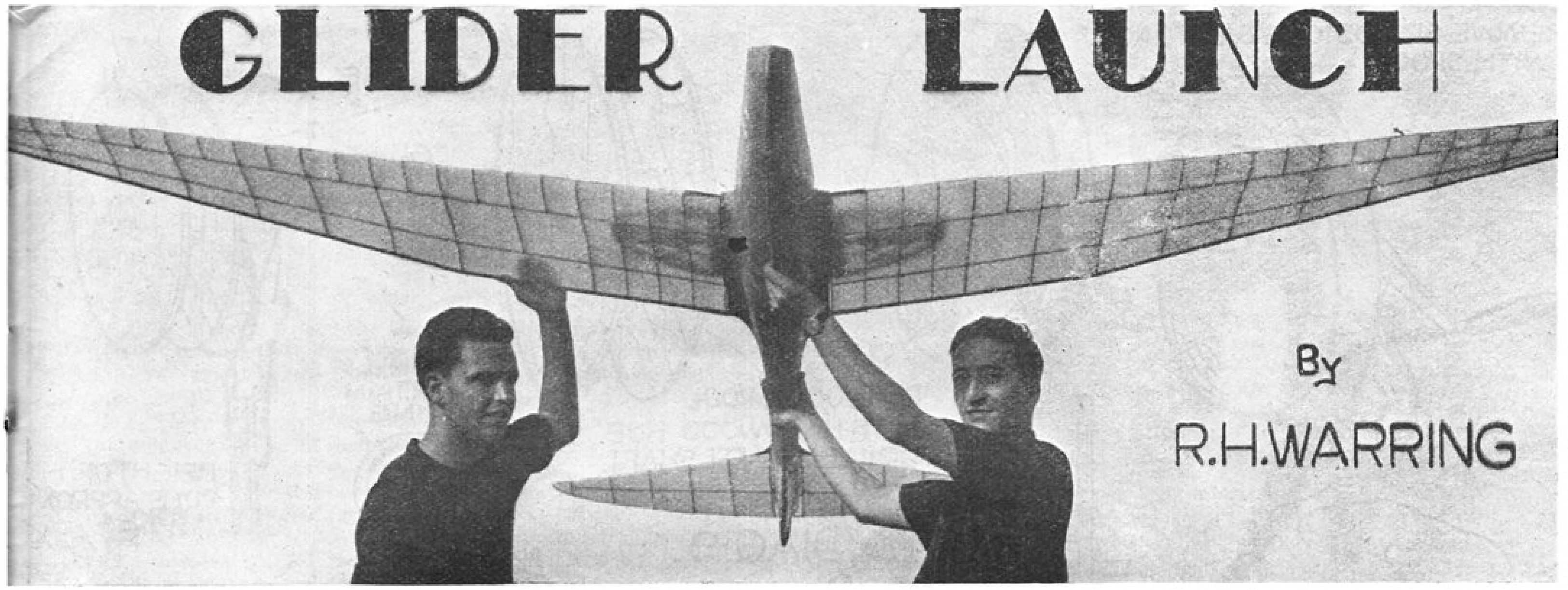

"H"
FRONT VIEW
BOTH AIRSCREWS
DOTTED LINE SHOWS PROFILE OF FRONT AIRSCREW.
"H"
USE 1"x1" BLOCK CEMENT PIECES "H" ON TO FORM SPINNER.
REAR AIRSCREW
SIDE VIEW.
FRONT AIRSCREW.
SIDE VIEW.
·A·H·S·

PLATE 2.

AIRSCREWS 11" DIA. FULL SIZE.

·POWER·
1 oz. 1/4" FLAT MADE INTO 10 STRANDS.

GLIDER LAUNCH



By

R.H.WARRING

Hand-launched Gliders

THESE may be divided into two classes—(a) small, all balsa models, launched by throwing upwards; and (b) larger gliders hand-launched from slopes, hillsides, etc. These may be anything up to 10 ft. span, and flights of up to 45 minutes have been obtained by German gliders so launched.

Class (a).—Models of from 8 in.—15 in. span, made entirely of balsa, and usually confined to the younger members of the club and beginners. They usually yield durations of from 20—30 sec., although out of sight flights have been obtained in England. However, their ease of construction makes them very popular for a young beginner to try his hand at modelling and learn something of the science of flight.

During launching considerable strain is thrown on to the wings, and the centre section is usually strengthened by a coating of cement. For finesse the whole glider should be polished to reduce drag.

Launching is quite a tricky process; the model should be held in one hand and hurled upwards, aiming at a high altitude without straining the wings. The model should flatten out or half-roll into level flight at the top of its launch, and this is where the skill comes in. Too often it will try to complete a loop and lose valuable altitude, if not burying itself in the ground! Thus a sideways and upwards launch is required to prevent these aerobatics.

The design is usually straightforward, but instead of a stick fuselage, one incorporating a fair side area forward of and below the centre of lateral area, is far more stable. The heavier the model the greater the height obtained in the launch (within reasonable limits, of course), but for indoor types a lighter grade of balsa is used, as the ceiling is usually restricted, and there are no up-currents.

Class (b).—Any type of glider is really suitable for hand launching from hillsides. In breezy weather, the large, more heavily loaded model gives the best results by being able to make headway, and not flopping about at the mercy of the wind.

The main difficulty here is to keep the model from circling back into the hillside. Many schemes of automatic rudder control have been suggested, but none perfected. Schemes involving a freely pivoted rudder had "rudder flutter," which certainly does not aid control! It is best to stick to conventional fixed control and trim as best suits the prevailing conditions.

Actually, this aspect of the sport is not practised widely in this country, perhaps on account of the lack of suitable grounds, but once the initial difficulties are surmounted it is a vastly intriguing pastime. The actual launch should be carried out just below the brow of the hill to avoid the dangerous burble which starts at the top. Not too far down, however, or you will be in a worse burble. However, there are many people more experienced than I who may be tempted to write on this subject, so I will leave the field open. Suffice to say that Goodwood, Sussex, has been the scene of many a crash from my attempts at rough weather soaring!

Catapult Launch

Until the King Peter Cup for gliders was inaugurated the catapult launch was the most popular for competition work in this country. The catapult consists of a length of rubber and line, the unstretched length of which must not exceed 100 feet. One end is firmly attached to the ground, and the other is tied to a wire loop which hooks over the towing hook on the glider. By stretching the line a suitable amount and releasing the model, it is pulled forwards and upwards until at the top of its "climb" the model slips the tow-line and commences free gliding flight. The altitude obtained is usually about 60 feet, and the average duration was of the order of 45 sec. Several extremely long flights have been made by this method, however, and Mr. Chasteneuf's 20 min. is an outstanding example.

Mainly small models, i.e. up to 300 sq. in. wing area, were used for this, and often a low wing loading. Streamlining was often resorted to, though, and many thermal flights obtained. The chief difficulty was with the catapult. The beginner, having nicely balanced his model, was wont to hook it on to the line, stretch it to its full capacity and let go. Immediately the model shot straight upwards, releasing itself prematurely from the line whilst still in a stalled position, putting its nose down, and then doing its best to bury itself. The sole reason was that the elastic part of the catapult was too strong. For models up to 8 oz. weight, 25 ft. of $\frac{1}{8}$ in. by 1/30 in. elastic is ample, with 75 ft. of line. Any size above this drags the model up too quickly, and causes a premature launch. Larger size models would, of course, need stronger elastic, but other methods of launching are usually employed.

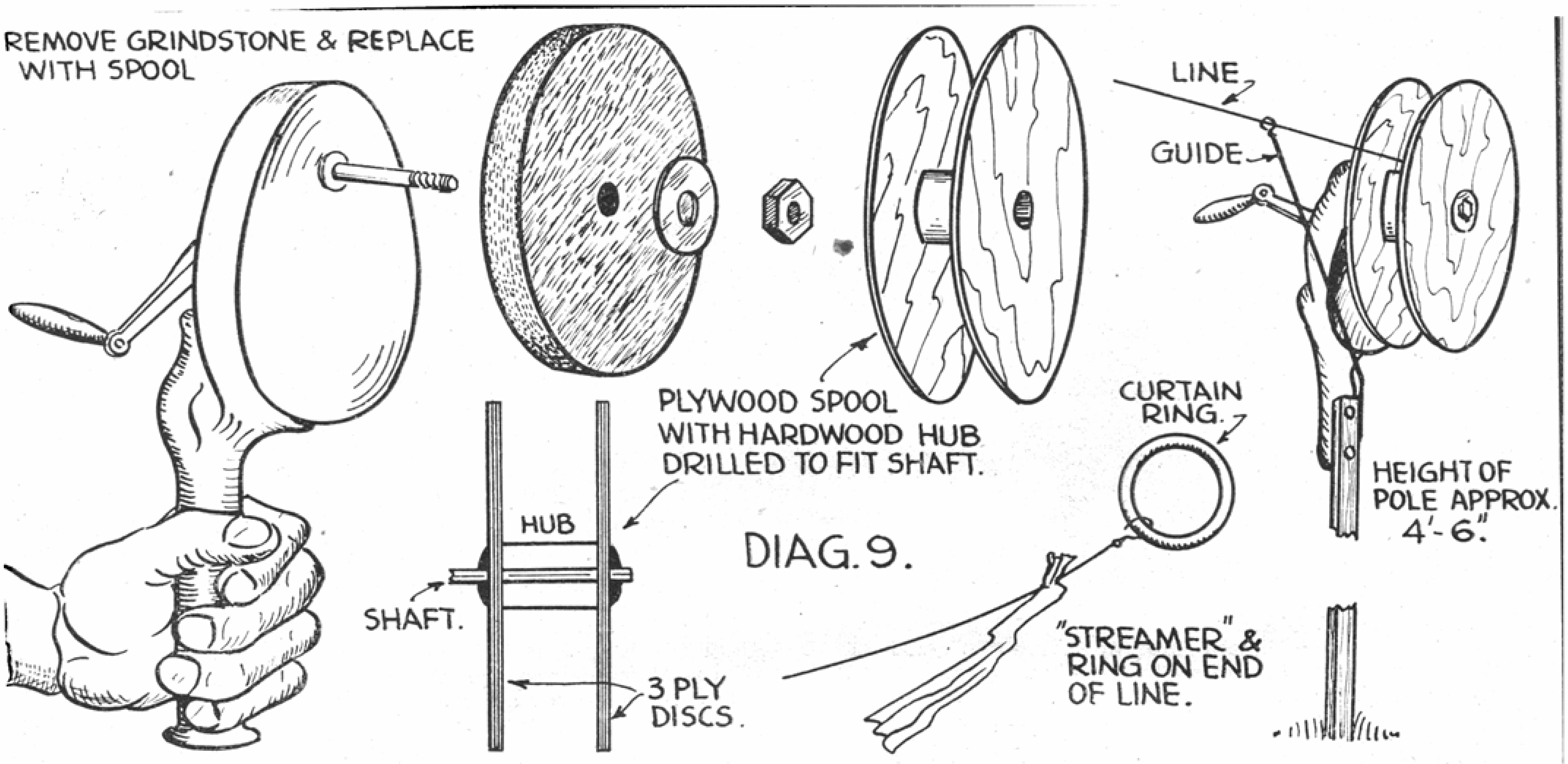
Running Launch

The "running launch," where a fixed length of inextensible line is used, one end fastened to a loop, hooked on to the glider, and the other held by the launcher, is sometimes used. By running forwards the launcher pulls the model forwards and upwards, the release being as before. If one wing tip drops control may be maintained by running towards that side, in fact, "playing" the model. This method is far from easy to carry out; a pair of eyes in the back of one's head would be a valuable asset!

In windy weather, the glider will often rise on its own like a kite without the launcher having to move. There are other variations of the running launch, but none are greatly favoured, and the winch launch is mainly used in competitions to-day. When first introduced it showed that a new technique was required, in fact, during the first few competitions utilising winch launching, the mortality rate of models was extremely high.

Winch Launch

The first essential is obviously the winch itself. For this purpose a hard grindstone, such as are fixed to work-benches by a clamp, can be readily adapted to suit our needs, diagram 9. The grindstone itself should be removed by undoing the retaining nut and washer, and a plywood spool fitted in its


REMOVE GRINDSTONE & REPLACE WITH SPOOL
LINE
GUIDE
PLYWOOD SPOOL WITH HARDWOOD HUB DRILLED TO FIT SHAFT.
CURTAIN RING.
HUB
SHAFT.
3 PLY DISCS.
HEIGHT OF POLE APPROX. 4'-6".
"STREAMER" & RING ON END OF LINE.

DIAG. 9.

place. The spool consists simply of two plywood discs separated by a circular hub; the hub is drilled through to fit on to the grinder shaft. The line, maximum length, 655 ft., is then wound on to the hub. A wire guide may be employed through which the line is passed; the guide itself being fixed to the case of the grinder.

A loop of wire, or a curtain ring, is tied to the free end of the line, and near it a short length of ribbon or silk, brightly coloured to assist in determining the exact moment the glider slips the line, and also help "spotting" the position of the line after it has fallen to the ground. Such a winch may be held in one hand, but since the rules do not allow the launcher to move outside an imaginary circle of 6 ft. diameter, of which he is originally the centre, it is usual to fit the winch to a short pole which rests on, or may be stuck into the ground, the other end holding the winch at a convenient height. A arrangement like this is more stable and relieves the operator of a certain amount of worry.

Now for the launching technique itself. (Note that it is better to practise firstly with only a small length of line run out, e.g. 100 feet, but in the following paragraphs it is assumed the whole length is used.) Firstly, of course, you must have your glider trimmed beforehand. Then, selecting a victim, you give him the end of the line tied to the launching loop, and direct him to walk downward with it, allowing the line to pay off the winch, as he does so. Barring unusual accidents or too small a flying field, this part is quite easy, but now your assistant is about two hundred yards away, and communication is a little difficult. However, by semaphore, megaphone, or any other means, you convey to him that you want him to return.

Right! You now give him the glider and tell him to take it to the end of the line, and hook same on to one of the towing hooks. Don't specify which hook though, as in the result of a crash you can always blame him for putting the line on the wrong one! (Seriously, though, it does need a little experiment to find the best position for maximum altitude.)

Now your assistant is two hundred yards away again, and remember, be careful, because it's *your* 'plane he has put on the line. Having plucked up enough courage, give an enormous yell (telling him to release the glider!) and commence to wind in gently. If your victim doesn't hear the yell he will feel the slight pull and release the model, or should do.

In all probability the model will shoot forward a few feet and come off the line, and, of course, you blame the fellow at "t'other end" again. Still, have another try and this time the model gets away nicely. The first bit of winding usually determines the rate of climb, so adjust it accordingly. Not too rapidly, or you will tear the wings off or strain the structure; not too slowly, or the model will not rise at all. Then it is up to you to play the glider, and wind at a rate that gets the model up to its maximum altitude, and allows a release at the proper moment. Actually, the longer on the line the better, for it allows a nicely controlled release and not a hurried slip off in a stalled position, but wind in a *minimum* amount of line to get the greatest height. Only practice is going to tell here, practice and a correctly trimmed glider.

Now let us imagine our glider is away on its own. The trim is good, and it is gliding nice and flat, but in extremely large circles—in fact, it seems to be going straight downwind. Time of flight about 100 sec., but it has obviously flown straight through any thermals that are about. A trifle more rudder should cure this, you decide, and so this is adjusted before the model is hooked on for another flight.

Before this, however, someone has got to find the line again—probably the long-suffering assistant in the distance. Having given it up, he comes to the winch end and traces it back from there, so we are ready to start again.

Once more on the line, once more away, and we commence winding—but what's wrong? Instead of a steady upwards climb the glider is dropping one wing tip and side-slipping downwards. Quick action is needed now—the model must be immediately released by slackening the line, when it stands a fair chance of recovery, but a flight of only 30—40 sec. Otherwise, if it hits the ground whilst still on the line, that's the end of *your* flying for the day! It was that "little bit of rudder" caused all this; a glider must be in a nearly neutral lateral trim to be launched successfully by a winch tow.

Let us go to the other end for a while and help someone else. Hooking the glider on the line, we hold it horizontal waiting for the word "go!" A pull on the line, and the glider has slid out of our hands, unless we were grasping it too firmly, when only a small part of it will go with the line!

Once away the glider appears to rush upwards; we hear the whistle of wind past the wings, and even see the wings themselves bow upwards under the tremendous lift. Only by standing at this end can we get an idea of just how much strain is put on those wings during launching.

Well, I've dealt with that subject in rather lighter vein, but most of the difficulties are clear. It needs practice to attain perfection, and the following points are most important:

1. A foolproof system of signalling from one end to the other is a great help. The launcher requires both hands, so it must either be a shouted word or signal given by a third party.
2. Always get the line dead downwind.

For the Launcher.

3. Wind fast enough to get maximum altitude, but never at an excessive rate, as this puts undue strain on the wings as well as "wasting" line.

4. Practise with your helper and develop your own technique.

For the Helper.

5. Endeavour to get the glider away in a flying position. Remember that just after release the model is not completely air-borne, and is liable to drop a wing-tip, so aim at a clean, quick release.

6. Never hold the glider too firmly in case an unexpected tautening of the line damages the model.

Of course, it is hardly necessary to add that the line must obviously be clear along its whole length, and not caught up in clumps of grass or other obstacles.

We are now left with the problem of trimming for circling, and two solutions are open to us. The first is a mechanical device whereby the rudder is held straight during launching and turned on release. On large models a time-switch can be used for this purpose, but it is also possible to utilise the tension in the line to the same end.

If the towing hook is pivoted inside the fuselage, the tension of the line during launching will hold it forwards As soon as this model has "slipped" the line the tension has disappeared, and the hook can be made to move backwards under elastic tension. Thus we have a small lever whose movement is controlled by the launching line. We can transmit this movement by means of strong thread to the rudder, and arrange it so that the latter is held straight during launch and turned during free flight. The rudder is biassed one way and held in a neutral position by the launching hook being forward. When this springs back the rudder moves under its bias, and this movement can be limited by a stop; the position of the stop controls the diameter of the circle. This method has worked on a 200 sq. in. glider, and results obtained were very promising (see last month's issue).

The other method is to obtain the required circle by rudder *and* wash-in of one wing. Now, when on the line, the drag of the "washed-in" wing is greater, and the model tends to turn in this direction, thus *neutralising* the rudder action. When released, of course, a normal circle results. This method is by no means so positive as the first, and needs delicate adjustment. It has the advantage of doing away with mechanical difficulties, however. Off-setting the towing hook is not favoured.

DYNAMIC BALANCE

by R. WATSON

An extremely interesting article that sets out a simple and effective method of balancing a single-bladed propeller dynamically, thus making it possible to eliminate the uneven running so often associated with this type. It should particularly appeal to modellers at the present time on account of the popularity of the single-bladed folding propeller.

ONE of the greatest difficulties in trimming a model with a single-bladed propeller is the complete elimination of vibration. This bugbear persists even if the propeller is balanced in the normal way, although it is known that it can be cured, or at least reduced, by bending the balance wire back. The difficulty arises in finding out just how far back the weighted wire must be bent and it was with a solution to this problem in view that the apparatus described below was devised.

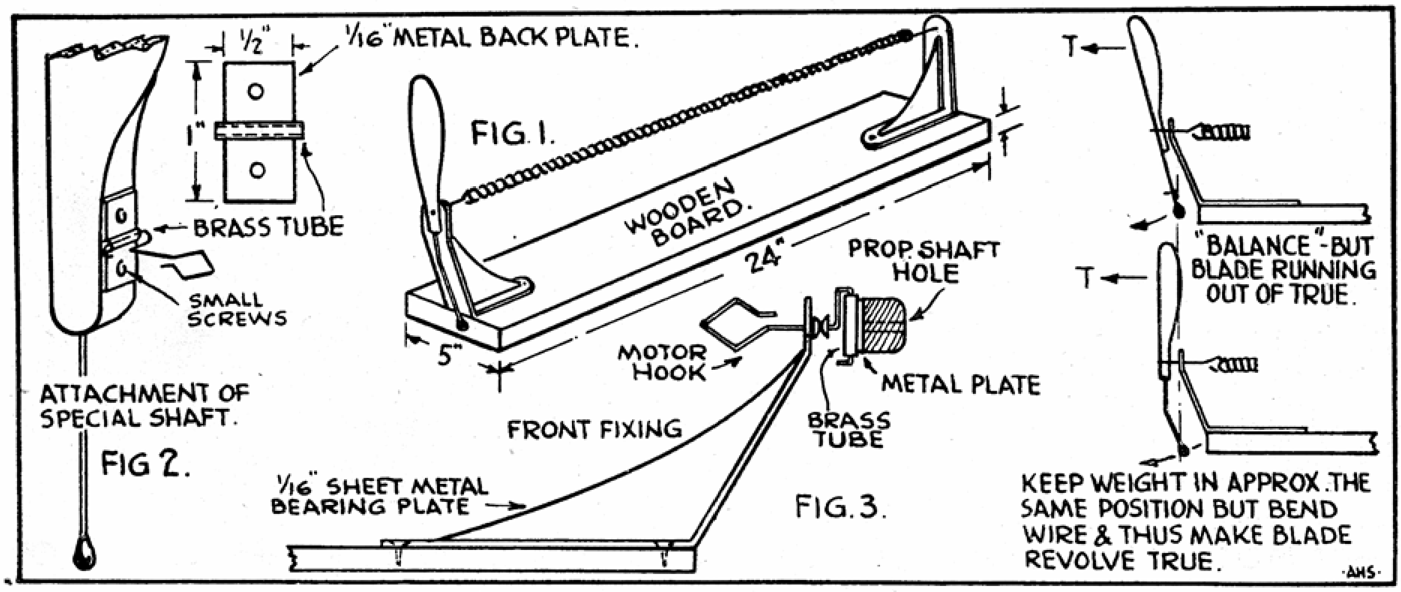
Essentially this consists of a flat baseboard with fittings at either end to take a rubber anchorage and a propeller shaft—the diagram should explain the general layout. The shaft end, however, is somewhat unique. Instead of the shaft passing through the propeller hub as in the normal case it is terminated on a special fitting consisting of a short length of brass tube soldered to a small brass plate. This plate has two holes drilled in it and the propeller under test is screwed to this plate.

This operation demands care as the propeller must revolve freely as it would were the shaft extended through the hub in the normal manner. To do this the special shaft must line up with the shaft hole in the hub. Now it will be seen that the propeller is free to revolve in the normal manner but it can also tilt backwards and forwards whilst doing so.

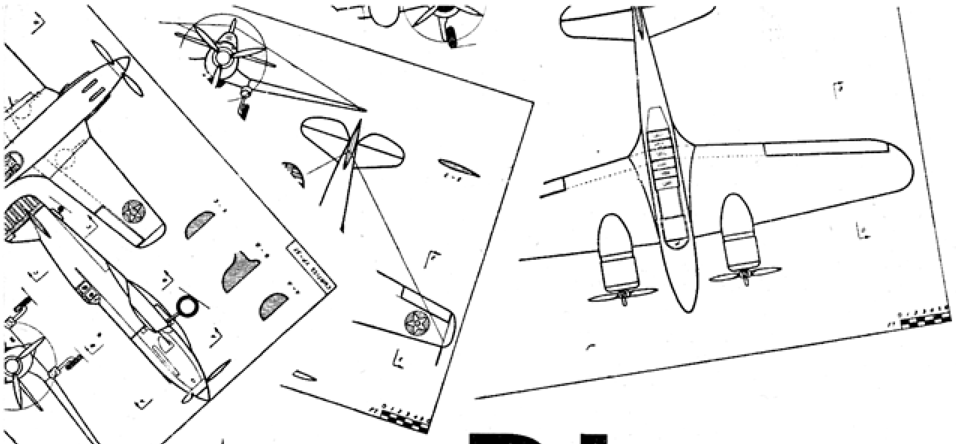
The actual balancing is done as follows. Fit your motor to prop shaft and rear hook, wind up and release the prop. Now the thrust on the single blade produces a couple which tends to tilt the airscrew disc, *i.e.*, make it revolve about an axis which is not perpendicular to the desired line of flight. This couple will be balanced by the centrifugal force acting on the counter weight tending to pull the latter forward and an equilibrium position will be reached when the propeller revolves steadily.

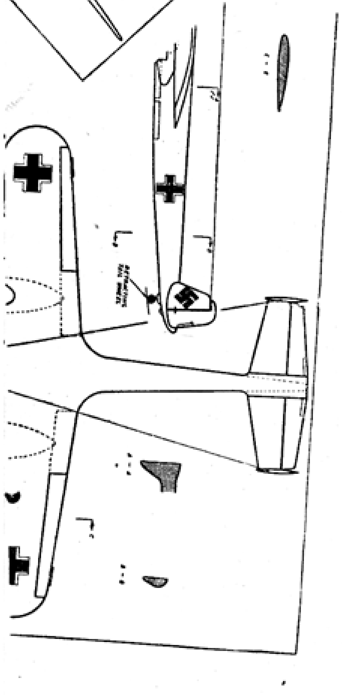
This represents the required position of the counter-weight for dynamic balance and the wire must be bent until the weight is in this position but with the *blade* revolving perpendicular to the propeller shaft. Actually this will have to be found by a series of "trials and errors" but the result will be a dynamically balanced propeller.

NOTE.—The propeller must first of all be balanced statically by the usual methods.



½"
1/16" METAL BACK PLATE.
1"
BRASS TUBE
SMALL SCREWS
ATTACHMENT OF SPECIAL SHAFT.
FIG 2.
FIG. 1.
WOODEN BOARD.
24"
5"
PROP. SHAFT HOLE
MOTOR HOOK
METAL PLATE
BRASS TUBE
FRONT FIXING
1/16" SHEET METAL BEARING PLATE
FIG. 3.
T
"BALANCE"-BUT BLADE RUNNING OUT OF TRUE.
T
KEEP WEIGHT IN APPROX. THE SAME POSITION BUT BEND WIRE & THUS MAKE BLADE REVOLVE TRUE.
·AHS·





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Blackburn Skua
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Miles Magister
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U.S.S.R.

I-15 Chato
I-16 Rata
I-17
R-10
S.B.-2 Katiuska
TB-3

U.S.A.

Curtiss Mohawk IV
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Bell Airacobra I
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Vought-Sikorsky Chesapeake
Northrop N-3PB
North American Yale I
North American Harvard II
Cessna Crane I
Douglas Havoc I
Douglas Boston III & Havoc II
Martin Baltimore I
Lockheed Hudson V
Boeing Fortress I
Consolidated Liberator I
Consolidated Catalina I
Brewster F2A-2 Buffalo
Curtiss SBC-4
Douglas (Northrop) 8a
North American Harvard
Douglas B.18a Digby
Martin 167-W Baltimore

ITALY

Caproni Reggiane RE.2000
Caproni Ca.135bis
Piaggio P.32 bis
Cant Z.1007 Alcione
Caproni Ca.133
Savoia-Marchetti S.M.81
Savoia-Marchetti S.M.82
Caproni Ca.311
Caproni Ca.312bis
Fiat C.R.42
Fiat G.50
Macchi C.200
Breda 65
Breda 88
Caproni 310 Libeccio
Savoia-Marchetti S.M.79a
Savoia-Marchetti S.M.79b
Fiat B.R.20
C.A.N.T. Z501
C.A.N.T. Z506b

CANADA

Noorduyn Norseman
Fleet Fort
Fleet Finch
D.H. 82C Tiger Moth
Fairchild M-62

AUSTRALIA

Commonwealth Wirraway
D.H.94 Moth Minor

GERMANY

Messerschmitt Me 109F
Focke-Wulf Fw 187
Focke-Wulf Fw 189
Arado Ar 95-See
Arado Ar 196
Heinkel He 60
Heinkel He 114
Fieseler Fi 167
Fieseler Fi 156 Storch
Arado Ar 96b
Dornier Do 17z
Heinkel He 59
Blohm & Voss Bv 140
Focke-Wulf Fw 200K Kurier
Blohm & Voss Bv 142
Dornier Do 26K
Messerschmitt Me 109E
Heinkel He 113
Junkers Ju 87B
Henschel Hs 126
Bücker Jungmann
Dornier Do 17
Dornier Do 215
Heinkel He 111K Mk. Va
Junker Ju 88K
Blohm & Voss Ha 139
Heinkel He 115
Dornier Do 18K
Dorner Do 24
Focke-Wulf Fw 58 Weihe
Focke-Wulf Fw 200 Condor
Junkers Ju 89K
Junkers Ju 52/3m
Junkers Ju 86K
Messerschmitt Me 110

GREECE

Hawker Horsley

JUGOSLAVIA

Ikarus IK-2
Hawker Fury (Jugoslav)

IRAQ

Hawker Nisr
D.H. 84a Dragon

FRANCE

Potez 63-11
Liore-et-Olivier 45 B.4
Morane-Saulnier Ms.406C
Dewoitine D-520
Potez 63
Breguet 690-1

POLAND

P.Z.L. P24
P.Z.L. Sum
P.Z.L. Mewa
P.Z.L. Los

HOLLAND

Koolhoven F.K.52
Koolhoven F.K.58
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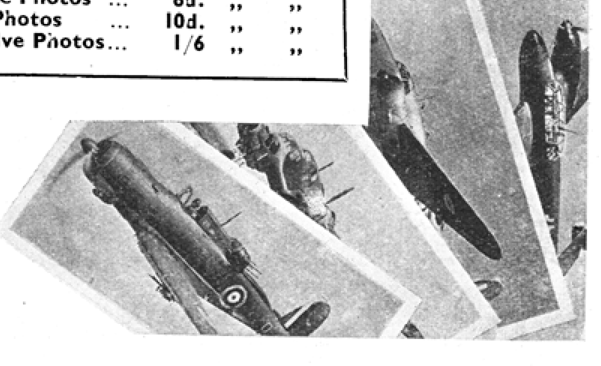

Since the publication of our catalogue in the January issue, we have considerably extended our range of high-class designs, including duration, flying scale, and glider types. Restrictions on paper supplies naturally prevent us issuing further catalogues at the present time, but we shall be pleased to forward our supplementary list on receipt of a stamped addressed envelope.

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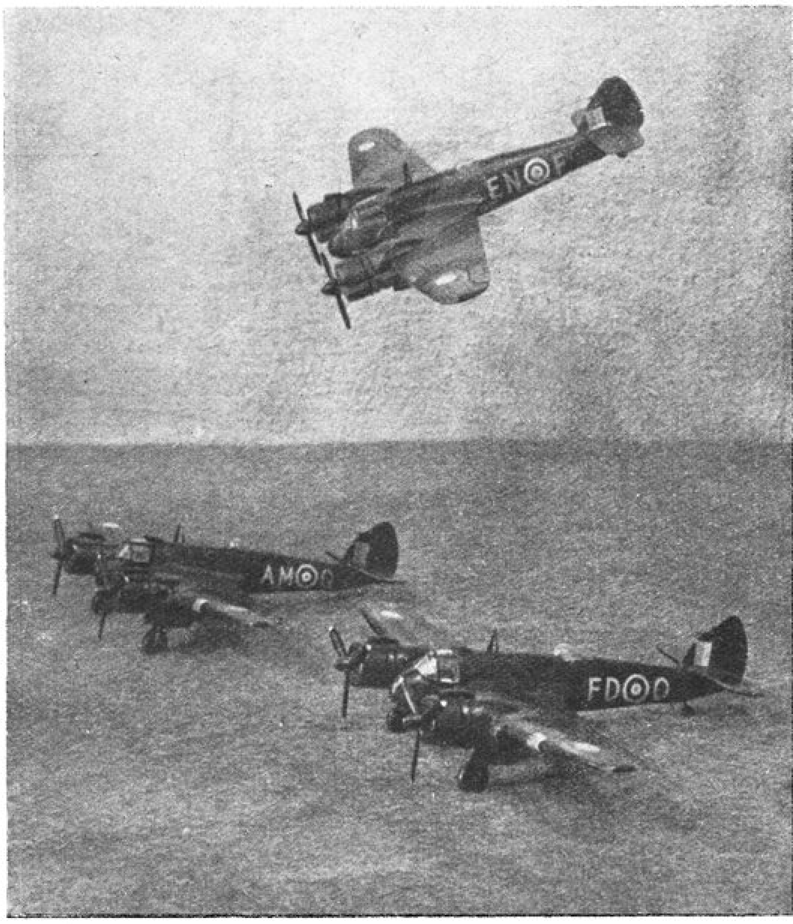


Beaufighters—$\frac{1}{72}$ solid models built by M. R. Rose from Aero-modeller plans.

MONTHLY MEMORANDA

No. 3 of Series

By O. G. THETFORD

EQUIPMENT OF THE UNITED STATES AIR FORCES

Continued from last month.

The designation system employed by the United States Navy is rather more complicated than that used by the Army since, in addition to mission letters, further letters indicative of the manufacturer are quoted. Special prefixes such as " X " and " V " indicate that the machine in question is experimental and heavier-than-air respectively, although the latter is only used in official specifications and correspondence and is never seen painted on the aeroplane itself. Of recent years the specifications for U.S. Naval aeroplanes have tended to encourage the multi-purpose or " maid-of-all-work " type as opposed to the highly-specialised machine capable of performing only one mission which is uneconomical from the stowage point of view on aircraft-carriers. Consequently, most machines at present in use have a double-designation with code letters indicating the primary and the secondary mission, the primary mission preceding the secondary. " OS " denotes that the aeroplane is primarily used for observation but can be employed on scouting duties if necessary.

Thus a complete designation is comprised of the mission letter or letters, the type number, the manufacturer's code letter and the modification stage number which is separated from the others by a hyphen and is equivalent to the British " mark " number. It will be seen that " SB2U-3 " indicates the second scout-bomber aeroplane built by the Vought-Sikorsky Co. in its third version. Quite recently, the policy of naming all the different types was approved and all current types have a name and mark number in addition to their letter designation.

The code letters used by the various manufacturers is as follows :—A–Brewster ; B–Beech or Boeing ; C–Curtiss ; D–Douglas ; E–Bellanca ; F–Grumman ; G–Great Lakes ; H–Hall-Aluminium or Stearman-Hammond ; J–North American ; K–Kreider-Reisner, Kinner, Fairchild, Keystone ; L–Loening ; M–Glenn L. Martin ; N–Naval Aircraft Factory (state built) ; O–Lockheed ; P–Pitcairn ; Q–Stinson ; R–Ford (state built) ; O–Lockheed ; P–Pitcairn ; Q–Stinson ; R–Ford ; S–Stearman ; T–Northrop ; U–Vought-Sikorsky ; W–Waco and Y–Consolidated.

Mission letters are :—H–Ambulance ; B–Bomber ; F–Fighter ; N–Trainer ; R–Transport (Multi-motor) ; G–Transport (single-motor) ; J–Utility ; JR–Utility Transport ; BF–Bomber Fighter ; T–Torpedo-carrier ; TB-Torpedo-bomber ; O–Observation ; S–Scout ; SB–Scout-bomber ; P–Patrol boat ; PB–Patrol-bomber ; PT–Patrol-torpedo-bomber.

The biplane fighters of the U.S. Navy have now been almost entirely replaced by the new monoplane types, but a few machines of the Grumman F3F–1 and F3F–2 type are still used at Coastal Stations by the Marines and for Reserve duties.

The Standard fighters on the carriers are the Grumman F4F series (F4F–2 Wildcat II ; F4F–3 Wildcat III ; F4F–4 Wildcat IV and F4F–5 Wildcat V) which is similar to the British Martlet and the Brewster F2A types (F2A–2 Buffalo II and F2A–3 Buffalo III) which are the counterparts of the British Buffalo Mk. I and II respectively.

Several types of dive-bombers are in use and they are officially described as " scout-bombers." The latest now going into service is the Brewster Buccaneer I (SB2A–1) (British Bermuda I). Douglas Dauntless (SBD–1 Dauntless I ; SBD–2 Dauntless II and SBD–3 Dauntless III) and Vought-Sikorsky Vindicator (SB2U–2 Vindicator I and SB2U–3 Vindicator II) (British Chesapeake I and II) have already been in action against Japanese naval bases in the Southern Pacific with marked success.

The torpedo-bomber classification is at present limited to a single type, the Douglas TBD–1 Devastator I, but a new type of Grumman is now going into production having just completed tests and is described as the TBB–1 Avenger I.

Very presently aircraft-carriers will be receiving what is described as the finest dive-bomber in the world, the new Curtiss SB2C–1 Helldiver I. The Curtiss Company pioneered the dive-bomber with their original Helldiver F8C biplane of the 1920s and the old name has been revived once more. (This time officially—the name Helldiver as applied to the SBC–4 Cleveland biplane is entirely un-official).

Spotter-reconnaissance types as carried on battleships and cruisers for catapult work are in general of fairly low power and correspond to a formula similar to that to which the British Fairy Seafox was designed. Types in use include the Vought-Sikorsky, Kingfisher (OS2U–1 Kingfisher I, OS2U–2 Kingfisher II, and OS2U–3 Kingfisher III) and the Curtiss Seagull I; which has the designation SO3C–1.

The patrol bombers (or flying boats) have been the subject of much attention by the Navy Department for many years, and the types is use are highly efficient. Organised in Air Fleets, each responsible for the patrol of a given area of ocean, they have actually taken over the scouting duties formerly undertaken by surface vessels.

The world-famed Consolidated Catalina is used in hundreds and in its latest form is designated the PBY–5—the Catalina V. Older versions still in use are the Catalina IV, PBY–4 ; Catalina III, PBY–3 ; Catalina II, PBY–2 ; and Catalina I, PBY–1. Four-motor boats of the Consolidated PB2Y–2 type, more akin to the British Sunderland in layout, are also with the patrol squadrons in numbers and have the name Coronado II.

The Glenn L. Martin Co's. two-motor PBM–1, Mariner I, and PBM–2, Mariner II, boats are just coming into service and the larger four-motor Mars XPB2M–1 is believed to be going into production following extensive service trials.

Hurricanes in Russia.

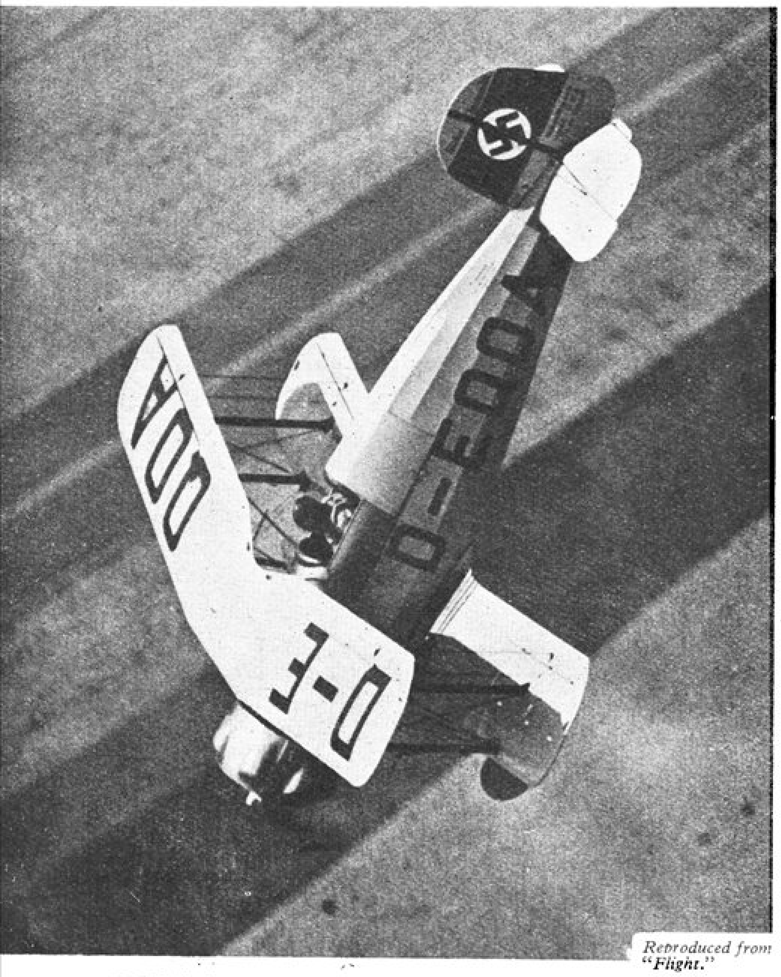
Recent news reels shewing the activities of No. 151 Wing of the R.A.F. in Russia depicted Hurricanes with the special air filter beneath the nose as carried on the Middle East version.

The Squadron letters FA were carried ahead of the cockade, but in place of the usual flight letter two-figure numerals were used to pick out individual machines. Normal British day-fighter markings were carried.

FIGHTING AIRCRAFT OF THE PRESENT WAR By H. J. COOPER

XVI THE BÜCKER JUNGMEISTER

XVII THE GOTHA GO 149



Reproduced from "Flight."

WHEN the *Luftwaffe* was first formed the German Air Ministry naturally required some training aircraft to supply the vast number of pilots called for by the enormous scheme, and two types of biplane, the Jungmann two-seat initial trainer and the Jungmeister single-seat aerobatic trainer built by the *Bücker Flugzeugbau G.m.b.H.*, of Rangsdorf, Berlin, were accepted for issue to the training schools in 1936. The two types are still in production, and since their introduction many hundreds have been built. They more-or-less form the German counterpart of the D.H. Tiger Moth, but are considerably smaller and have greater power.

The Jungmeister is of attractive appearance, and is as fast and manœvrable as it looks. The photograph above shows a Jungmeister being exhibited by Rudolf Lodern, who before the War was a well-known sports aerobatist in Germany. This 'plane is silver doped with black lettering, and carries a black swastika on a white disc painted on a red background.

The Jungmeister is slightly smaller than the two-seat Jungmann, and with a more powerful radial motor is some 20 m.p.h. faster, but the two are almost identical in construction.

The wings, with 11 degrees of sweepback, are of wooden construction and are fabric covered. The fuselage is of welded steel tube with fabric covering.

The Jungmeister can be fitted with the 140 h.p. Hirth HM 506 four-cylinder in-line motor or (as shown above) with the 160 h.p. Siemens Sh 14 A.4 radial. With the former motor the length is increased by 16-ins.

Besides being in service in Germany. Bücker biplanes have been supplied to most European countries for service and civilian use and were often seen at the International Sports Meetings held in this country prior to 1939.

General particulars for the radial-Jungmeister are :—

Dimensions.
Span : 21 ft. 7½ ins.
Length : 19 ft. 4 ins.
Height : 7 ft. 4½ ins.
Wing area : 130 sq. ft.
Weights.
Tare : 925 lbs.
Loaded : 1,290 lbs.
Loadings.
Wing : 10 lbs/sq. ft.
Power : 7.29 lbs./h.p.

Performance.
Max. speed : 134 m.p.h.
Cruising speed : 125 m.p.h.
Landing speed : 54 m.p.h.
Climb : 1,170 ft./min.
Climb to 3,300 ft. : 2.8 mins.
Climb to 6,600 ft. : 6.3 mins.
Climb to 9,900 ft. : 10.7 mins.
Ceiling : 20,000 ft.
Range at 125 m.p.h. : 310 miles.

★ ★ ★

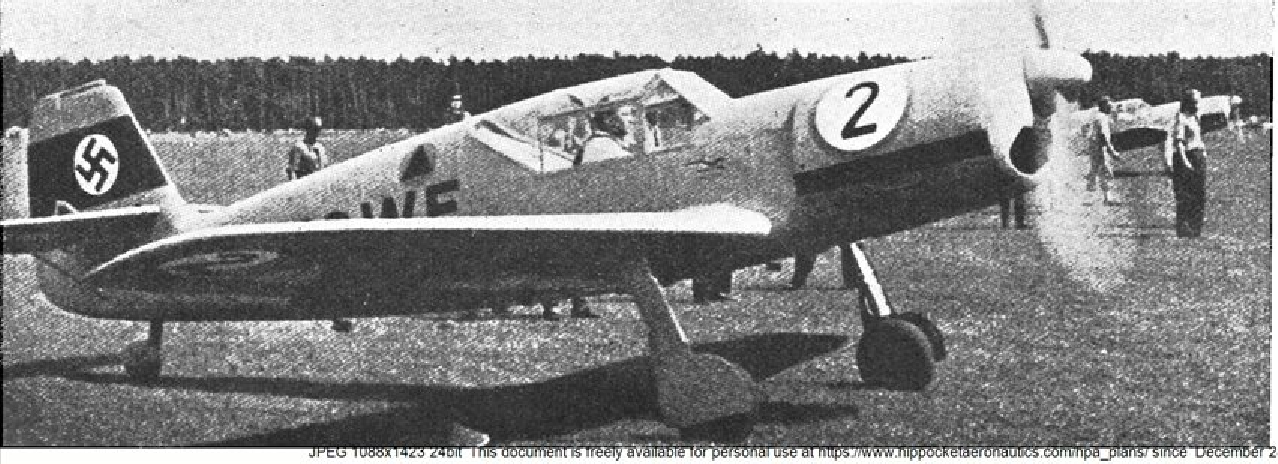
The Gotha Go 149 also is a single-seat aerobatic and sports aeroplane, but is a low-winged monoplane fitted with a 240 h.p. Argus As. 10C eight cylinder inverted Vee motor.

The wing is built on a single wooden spar and covered with stressed plywood; the fuselage is an elliptical-section all-metal monocoque. Full night-flying equipment is carried, and for training purposes a machine-gun can be fixed to fire forward.

The Go 149 is not in service in very large numbers, and is no longer in production. A few were supplied as sportplanes to some German pilots and were exhibited at the various Sports Meetings in Germany. The photograph below shows one, with the late Generalmajor Ernst Udet in the cockpit, taxying to take off at the 1938 Frankfurt Flying Meeting. An early Go 149, with a horn-balanced instead of a mass-balanced rudder was registered D-EJFR. This 'plane was coloured all silver and had black letters. The swastika was painted across the fin and rudder as on the Jungmeister.

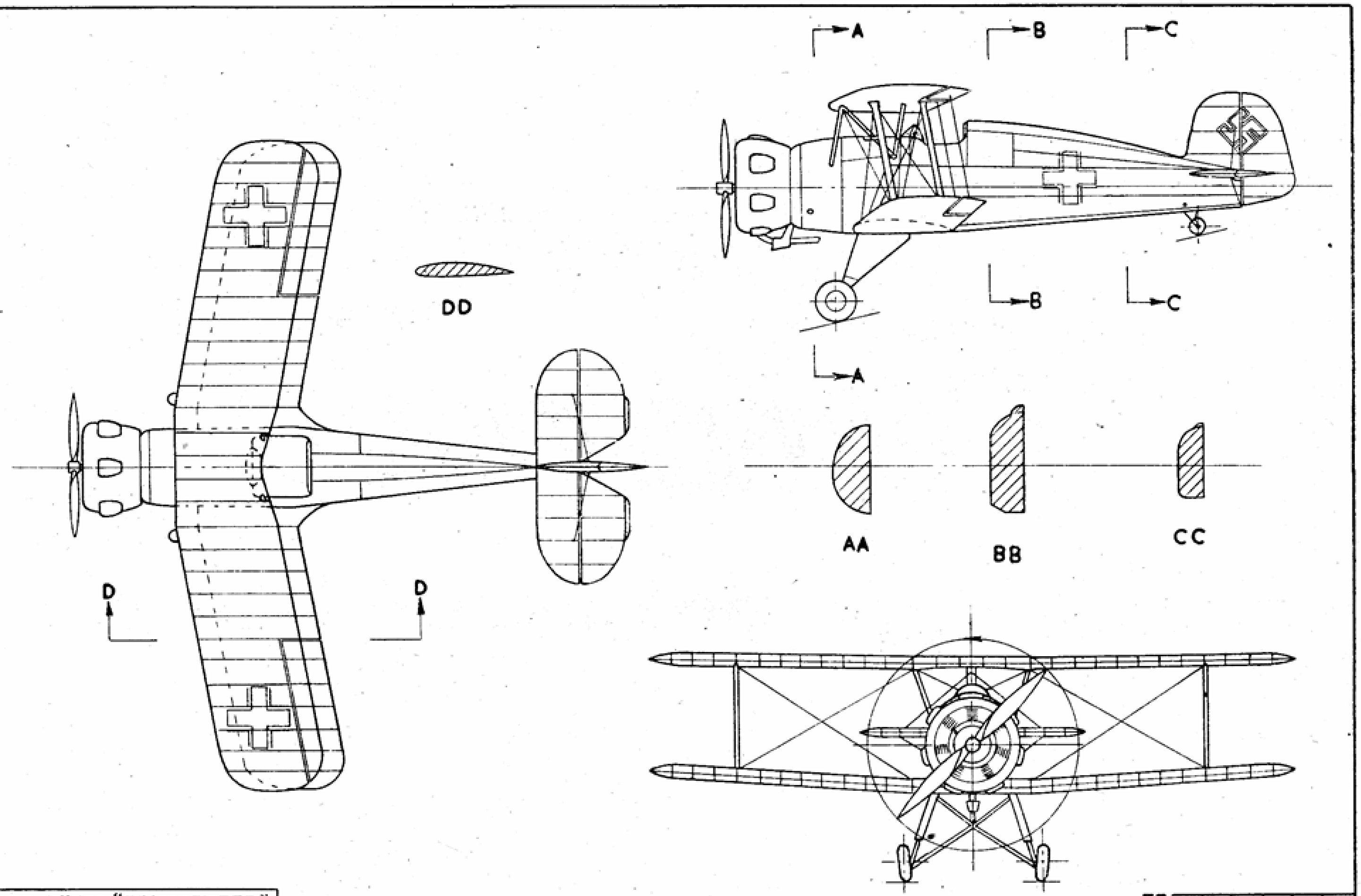
Dimensions.
Span : 25 ft. 6 ins.
Length : 24 ft. 0 ins.
Height : 6 ft. 9 ins.
Airscrew dia. : 7 ft. 5 ins.
Wing area : 122 sq. ft.
Weights.
Tare : 1,764 lbs.
Loaded : 2,315 lbs.
Disposable : 551 lbs.

Loadings.
Wing : 18.98 lbs./sq. ft.
Power : 10.41 lbs./h.p.
Performance.
Max. speed : 214 m.p.h.
Cruising speed : 199 m.p.h.
Landing speed : 59 m.p.h.
Climb : 1,650 ft./min.
Climb to 3,300 ft : 2¼ mins.
Ceiling : 19,700 ft.
Range at 199 m.p.h. : 615 miles.

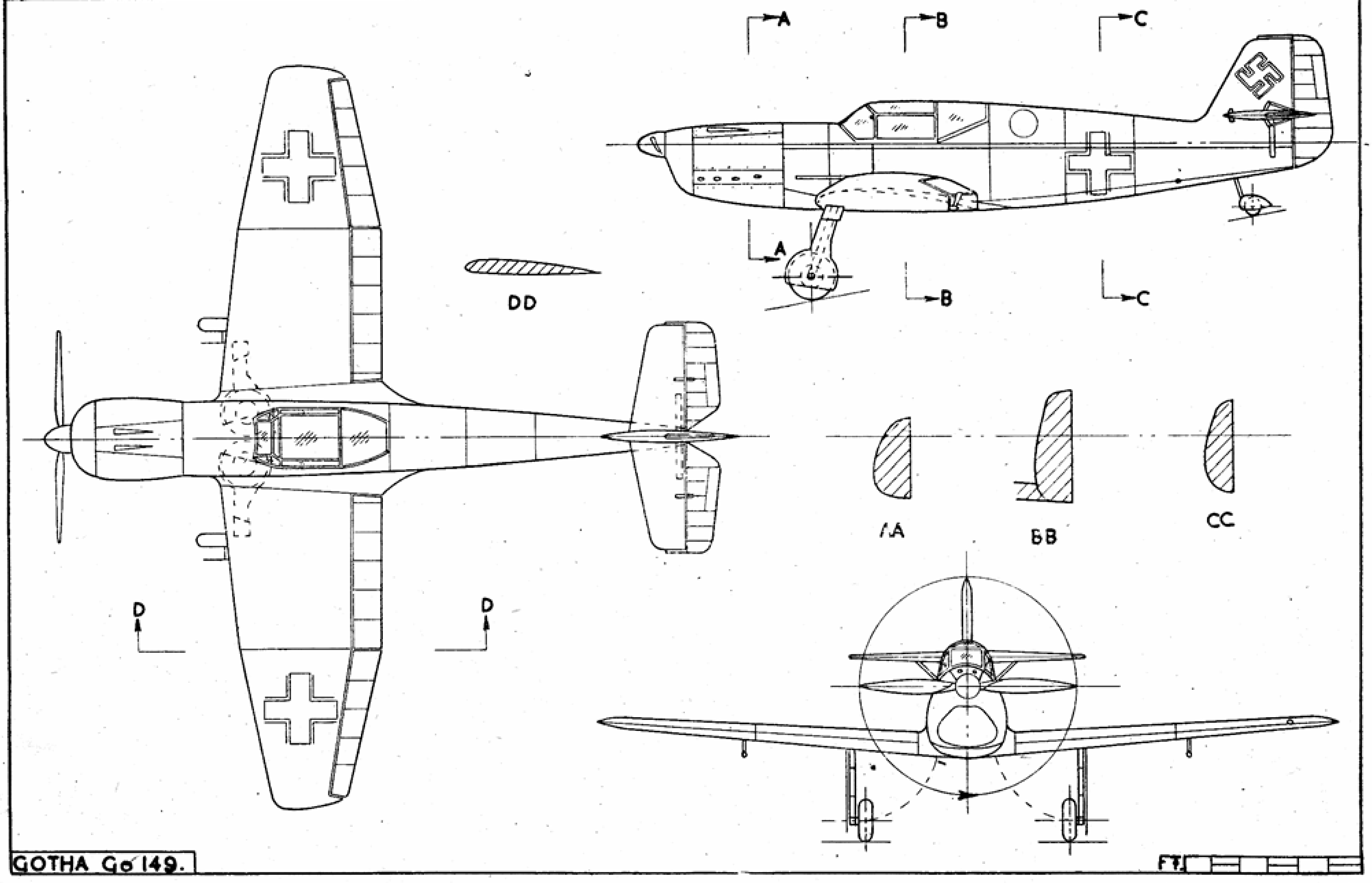


Reproduced from "The Aeroplane."

Next Month: The Westland Whirlwind I.



BÜCKER BÜ 133 "JUNGMEISTER".



GOTHA Go 149.

The Superiority of

KEIL KRAFT KITS

has built up an enormous demand

Deliveries, temporarily, are difficult

Please be patient—we are doing our best

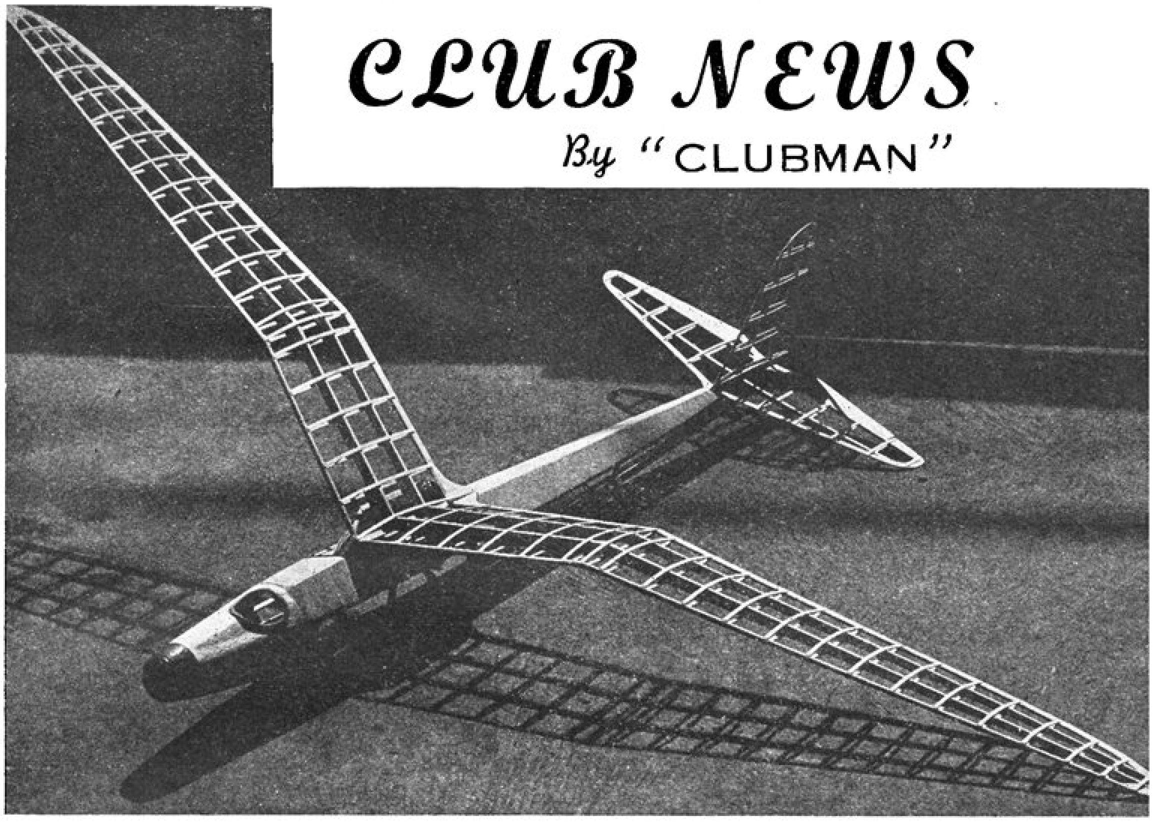
WHOLESALE ONLY

E. KEIL & CO. LTD., LONDON, E.2.

CLUB NEWS

By "CLUBMAN"

Two fine snaps of a glider built by W. Snook. The planked fuselage is noteworthy, also the incorporation of a rubber ball in the nose, this taking all " head-on " shocks.



I REGRET I must start my monthly chatter with a decided grouse and stern warning. This will not, I know, apply to the majority of my readers, but in order to get at one or two black sheep it becomes necessary to devote a certain amount of space this month in trying to eradicate an evil which will have very serious repercussions if allowed to continue.

It has come to the notice of myself and several others that the Air Ministry ban on the flying of petrol models is being ignored in some instances. Now the restrictions which were imposed on the 3rd August, 1940, are plain enough in their context, and state definitely that " *the flying of all types of petrol engined model aircraft is prohibited.*" It is annoying to discover that there are certain irresponsible people in our hobby, and I very much regret the circumstances that make it necessary for me to speak on these lines. I do, however, appeal to all keen aero-modellists (and I know the majority of you are keen) to report all such contraventions of the rules wherever you may come across them. It is only by so doing that you will help to preserve the fairly lenient facilities we are enjoying at the moment, and nobody in their right senses would class such a report as sneaking. After all, we can only brand the class of chap who is breaking the rules as a Fifth Columnist, and it should be apparent to everybody that to allow such practices to continue is eventually going to affect the majority of chaps who are doing their best to assist rather than hinder the movement.

Any complaints forwarded to me will be treated with strict confidence, and forwarded to the officials of the S.M.A.E., who will, of course, deal with all such matters. The S.M.A.E. were assured by the Air Ministry that they have no desire to restrict model flying any more than is absolutely necessary, but it will be obvious that any continued disregard of the rules will get heavier restrictions placed on our hobby, and nobody wants to see that come about.

We do get reports, of course, of petrol models being *built* and there is nothing in the Regulations to prevent such designs being prepared in readiness for post war flying. The only stipulation is that these shall not be *flown*.

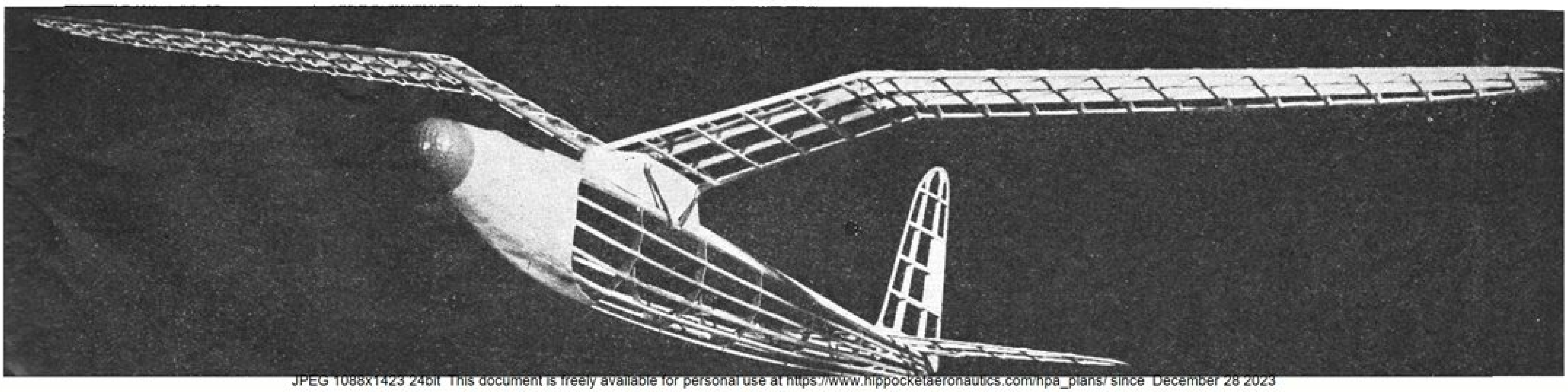
I see from the S.M.A.E. announcements that a wide range of competitions has been fixed for the present season, with the accent on model gliding. Personally I am very pleased to see this, as I feel there is now a long-awaited opportunity of bringing British model gliding on a par with the Continental types.

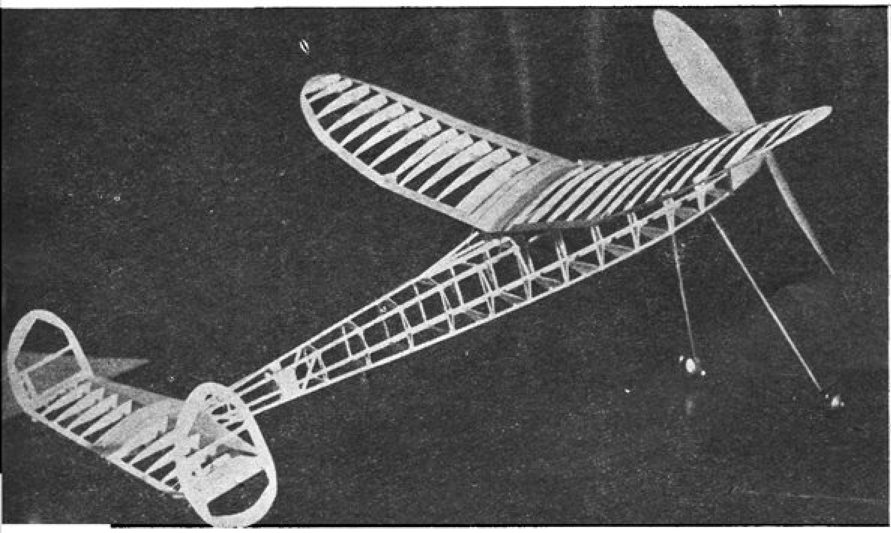
The introduction of an additional " open " contest (on similar lines to the Gamage Cup) should meet with universal approval, as the entries for the Gamage over the last few years proves that this is the most popular type of contest held.

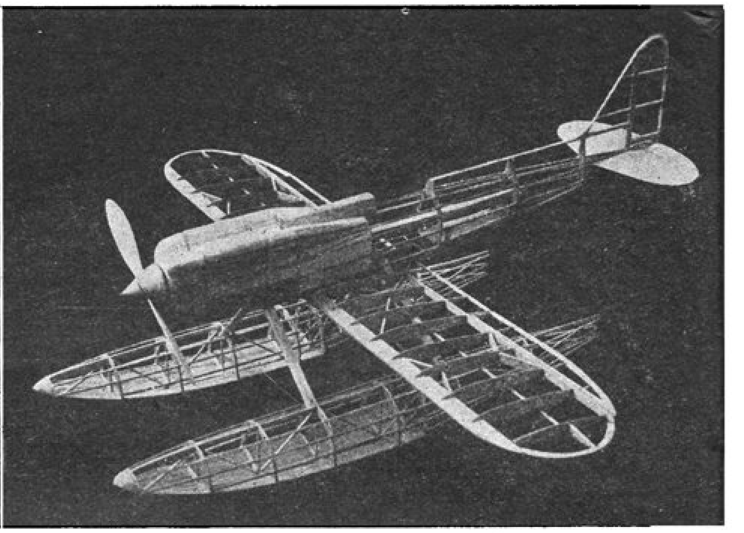
I note that the S.M.A.E. are stressing the need for proper supervision by all club officials when conducting de-centralized contests, and although I know this is difficult in some instances, it is the duty and responsibility of club officials to see that the necessary rules are carried out to the letter. Having seen some of the models that were disqualified at some of the pre-war Wakefield Elimination Trials makes one wonder just how many models really do measure up to the specifications, and how many are thoroughly checked. More than this I am not prepared to say, but still—it makes you think ! !

I am asked to point out that communications to the S.M.A.E. *should not be forwarded to the Royal Aero Club*, as this only makes for delay in answering letters, and creates unnecessary complications. Club officials should carefully note the names and addresses of the various officials, and for those of you who do not receive the official S.M.A.E. Bulletin, I would point out that the Hon. Secretary is Mr. A. G. Bell, 70, Nelson Road, Hornsey, London. It is surprising the number of enquiries we get at the " Aero Modeller " offices asking for particulars of the S.M.A.E., and it becomes apparent that more publicity should be given to the Secretary's name and address. We are arranging that this shall appear in every issue of the " Aero Modeller " from now onwards.

Another matter mentioned is the absolute necessity for advising the Society (also the " Aero Modeller ") of any changes in secretarial appointments. Unfortunately, we have had a number of cases where we have notified a prospective member of the club secretary's name and address, only to be later informed that no information could be obtained from the address given. Will all Clubs, therefore, please note it is







Two contrasting types are shown here. Left-hand model is a Zaic "New Yorker," built by W. Jones of the Golden Wings (Leicester) M.A.C. This model was built from substitute woods, and weighs 9½ ozs. The other model is, of course, of the deservedly popular Supermarine S6–B (forerunner of the Spitfire) and was constructed by E. W. Carter of Burgess Hill.

essential that we are kept informed of any changes that take place.

A final request I have is from the secretary of the National Guild of Aeromodellists, who asks me to broadcast the news that lapel badges are no longer available. Existing stocks have been exhausted and the present situation in the metal industry does not allow of further orders being undertaken at the present moment. Should the situation improve and these badges again become available, an immediate announcement will be made.

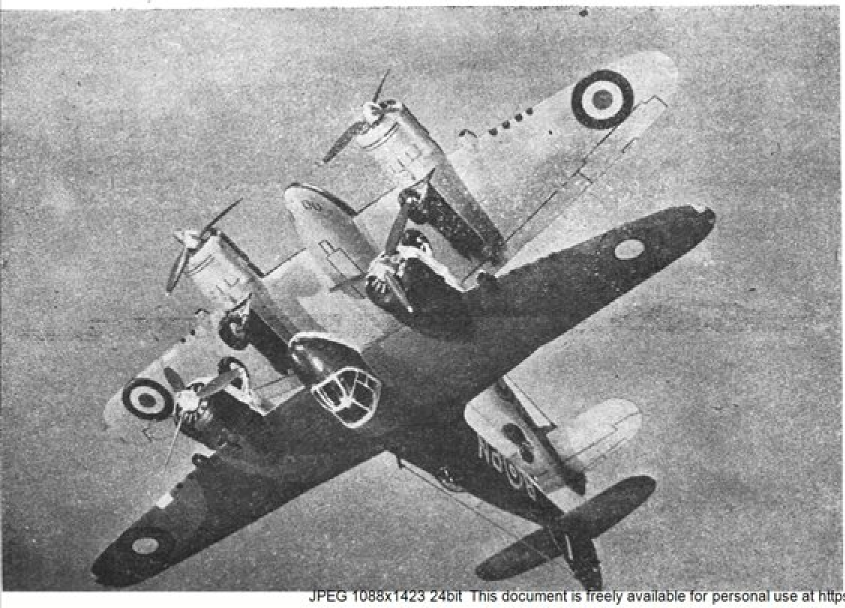
Well, as I write this the weather has certainly taken a decided change for the better, and I hope we are going to have what we have always hoped for, a tip-top model flying season. Difficulties and restrictions are bound to hamper most clubs to varying extents, but we are getting used nowadays to overcoming such pettifogging snags.

Ground facilities seem to be the biggest stumbling block, but as long as we are all able to continue flying in some measure we must be satisfied.

Personally, I did very little flying during last season owing to a variety of duties, but I am hoping to get at least one model out of the box this year! I am quite expecting it to look like a sieve, and a whole army of moths to be strangled as soon as the motor is wound for the first time, but then I shall just breathe some of my hot air into the holes and I should be able to turn my streamliner into a dirigible!

I see a number of clubs are already announcing various rallies and open meetings, and I cannot commence the season better than by wishing them the very best of luck and weather, and successful flying to all concerned.

Our old friend, Ron Mackenzie, of the BLACKHEATH M.F.C., writes from America, where he is undergoing an extensive R.A.F. course . . . and enjoying every minute of it! Mr. Symons, a well known member of the club, is commencing a series of lectures on simplified aerodynamics, and a welcome is extended to any new prospective members who are interested.



Though flying has been scarce lately, building is going on at a feverish pace, and one new member has produced no less than fourteen 'solids' in the eight weeks of his membership.

Members of the newly-formed CIRRUS (Tunbridge Wells) M.F.C. held their first rally on the Common at Tunbridge Wells on Sunday, March 1st. A large number of people attended the rally, which included exhibitions of mass-launching, R.O.G. flights, etc., and this initial meeting was a great success. The first club H.L. record was set up by Corporal P. Gibby, A.T.C., flying a "George" model, time being 1 : 5.5. The club numbers several members of the Air Training Corps among its ranks, and new members will be welcomed. It is a regulation of the club that all members must be registered with the N.G.A.

We are pleased to welcome yet another new club in the BRITISH AIRWAYS M.F.C., with headquarters at Chippenham, Wilts. Originally formed by three enthusiasts, the club soon grew, and a regular programme of contests is now conducted. Chris Jennings put up the best time of the year with 3 : 51, though a flight of over 15 minutes was presumably not officially clocked. With the dirty weather, flying was taken into the hangars and the best time to date R.T.P. is 92 sec. A cup was also presented for scale models, these being flown R.T.P. with an 18 ft. line. This resulted in some excellent models competing, including Airacobras, Tomahawks, Mohawks, a Beaufighter and last, but certainly not least, the ever popular Leopard Moth. The present holder of this cup won the event with an Airacobra. A further cup, presented for a high speed event, has not yet been competed for, but in several timed flights, R.T.P. 14 ft. radius, speeds of just over 40 m.p.h. have been recorded.

The STRATFORD-ON-AVON M.A.C. are still hard at it with exhibitions, the latest effort being in aid of the local Warships Week. One successful feature was a "guessing competition" where a model of 3 lbs. produced guesses ranging from 10 ozs. to 10 lbs. Blimey—some folk must think we use oak to build with!!

Large gliders are making their appearance in many clubs, including the HULL & D.M.A.C., where last season's record of 1 : 20 looks ready for a bashing. One member has found that "anti blast" solution is a good thing to use for model doping, a fine gloss resulting, and good tightening properties being evident. This must be applied thinly, however—and don't blame me if your fuselage concertina's.

The ST. NICHOLAS M.A.C. (Leicester) has now been in existence for six months, and membership stands at 43. R.T.P. flying has shared popularity with "solid" work, best time to date being 30 secs. Two "Miles Magisters" built from "Aeromodeller" plans have done some good flying, one constructed by the Rev. Sherwood being entirely of hardwoods, with an all up weight of 9 ozs.

Some sixty visitors attended the indoor meeting of the BIRMINGHAM M.A.C., and enjoyed some interesting flying.

PUZZLE CORNER:

This model, built by Mr. Bridges of Banbury, was photographed in position on a mirror, thus getting both "down" and under" views on the one negative. Cute eh!

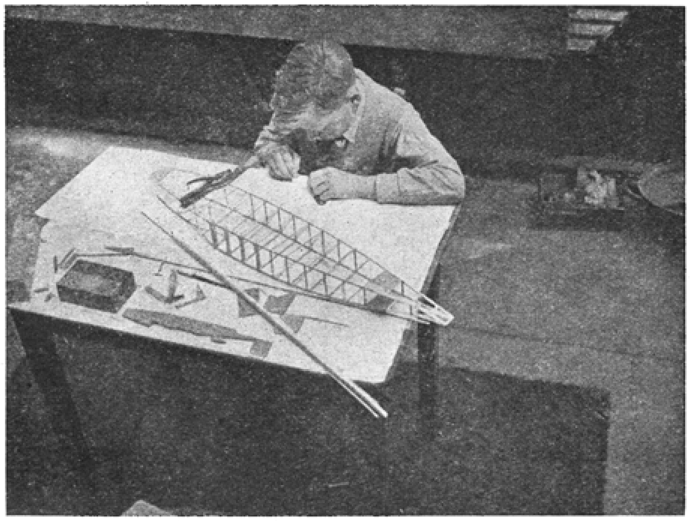
Full results were :—

Microfilm	H.A. Hassall	153.2 secs.
	G. Bradwell	91. ,,
	T. Bradwell	77. ,,
R.T.P. (1 *oz. models*)	G. Bradwell	102.4 secs.
	W. Bushell	68. ,,
	C. Doughty	63. ,,
R.T.P. (2 *oz. models*)	D. Braes	158.4 secs.
	W. Bushell	68.2 ,,
	A. Brown	67.4 ,,

All flights were the aggregate of two attempts.

CROYDON & D.M.A.C.
will hold their
WHITSUN GALA DAY
on Epsom Downs
May 24th, 1942.

Nomination (H.L.) Open Duration (R.O.G.)
Flying Scale (H.L.) Team Contest (R.O.G.)
Glider competition.
£5 in prizes. £5 in prizes.
Full details displayed on the field.

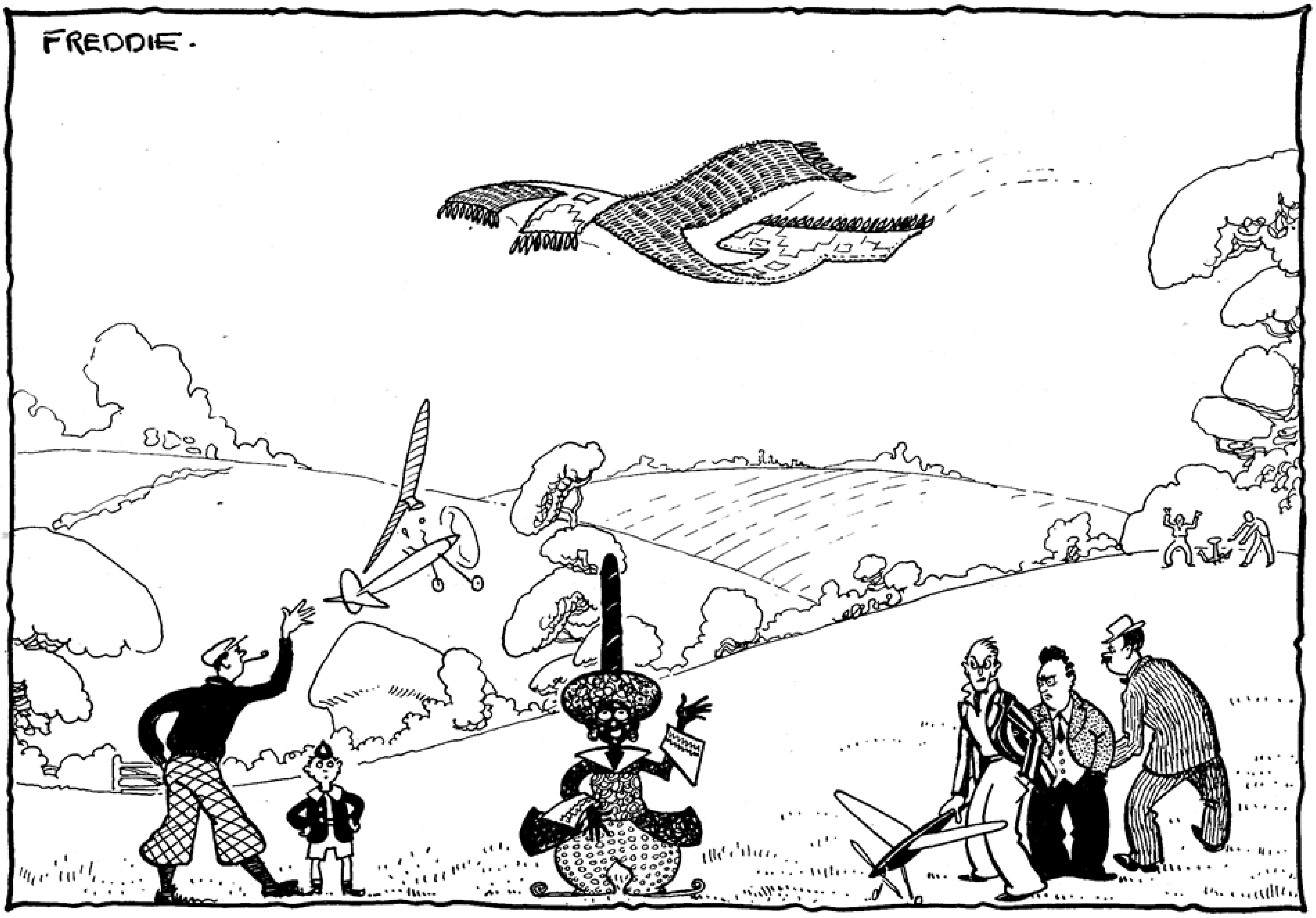


The young idea gets down to it, though it looks as though he has been relegated to the outhouse! Master C. B. Day of Leicester busy on his "Korda."

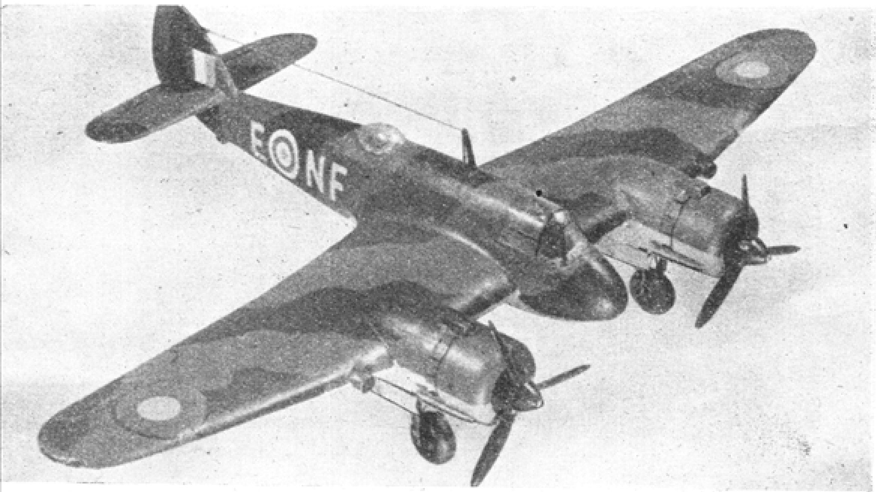
The DERBY M.A.C. is now affiliated to the S.M.A.E., and hope to take a wider interest in national competitions in consequence. 'Aero bees' are proving popular, and inter-club events are being arranged with local spotters.

The BEVERLEY & D.M.A.C. held an "open" scale model contest on the 1st March, F. Longson of the club carrying off both the "open" and "club" events. Contests for the annual Rally consist of "under 30 in. span Duration" and "Over 30 in. span Duration," both of which are H.L.; Gliders, average of 3 flights winch launch, Wakefield, average of 3 R.O.G.; and Flying Scale.

The LLANDUDNO M.A.C., which struggled through last season against odds, is to reorganise on the 1st April, and new members are welcomed. Please get in touch with the secretary, J. M. Battimer, 2, Craig-y-don Parade, Llandudno. (We actually hear from this club of an *Oak* model glider, which consistently puts up times of 70 secs. Seems I'm more of a prophet than a humorist !)



" HE'S BOUND TO WIN—HE MADE IT FROM A MAGIC CARPET ! ! "



Yes! it's another Rose feature, this time a "Beaufighter" built from A.M. plans. This chap certainly knows his onions when it comes to solid modelling.

Some interesting models are notified from the MERSEYSIDE M.A.S., where Cliff Billingham has been getting some remarkably consistent times with his new Wakefield design. Flights of 3:30 (on 350 turns) and 3:45 on 375 turns have been clocked. R. F. L. Gosling has completed a new streamlined glider, with automatically controlled trim-tab that operates when the model leaves the line, while I. S. Cameron has a new job employing the Davies Airfoil, and a tensioner completely contained in the hub and spinner.

K. Hussey of the ST. IVES (Hunts.) M.A.C. has raised the club lightweight record to 2:15 with his "Ajax," while L. Geeson's 'Copland' model clocked 2:20 on test flights. These two chaps hold a number of places in recent contests, and share the honours with R. Sellers, who took five places in six competitions.

Three petrol jobs are being built by the SPELDHURST (Kent) M.A.C., and work is progressing on a radio controlled receiver. We shall be pleased to hear more of these projects—and to know that they are not being flown at the present moment!!

OPEN RALLY—May 24th, 1942
OPEN CONTEST.
Wakefield Glider: Time Limit.
E. G. BALL, Secretary,
"Gran," 2, City Gardens, St. Helens,
Lancs.

Members of the EBBW VALE M.A.C. put on a good show at a recent exhibition and netted some good local publicity in consequence. A number of well built models received good attention, and Fred Williams was presented with a cup, won in competition with the Northern Heights M.F.C., in which his model aggregated 7:55. (Incidentally, does anyone know whether the N. Heights have deceased? Trot out the body—we haven't heard a peep for months).

The NORTH COVENTRY M.A.C. recommence outdoor activities at Barnacle (No—not you Momma, sit down!) on the first Sunday in April, and will continue every Sunday from then on . . . as long as members turn up!

News of the FURNESS (Barrow) club will be welcomed by the MILLOM & D.M.A.C., who wish to introduce inter-club events.

An indoor meeting held in conjunction with the Harrogate boys was staged by the RIPON M.F.C., the results of the flying being a win for D. Hale (Harrogate) with 53½ points (POINTS not PINTS), followed by A. H. Morris (Ripon) with 52⅔. Latest records to go by the board are the "over 18 in. span R.T.P." which goes to C. F. Elliott, 1:21.5 and the "under 18 in." class bagged by W. S. Elliot with 1 minute.

The LEICESTER M.A.C. are pleased to announce that at long last ideal outdoor flying facilities are now available at Scraptoft, and it is hoped that the quality of flying will improve in consequence. Meetings open on the 5th April, and for the coming season the junior members have been divided into teams for competition purposes.

Another plea for a senior aeromodeller to start the ball rolling with a view to forming a club comes from East Kirby, Notts. If one of the older chaps would like to get cracking, E. Wilcox, of 71, Prospect St., would be pleased to hear, also all his pals.

The WEST BROMWICH M.A.C. has closed down for the duration.

W. A. Dean, of 151, High Street, Cheltenham, wishes to purchase Nos. 25–30, 47–53 and No. 69 of the "Aeromodeller." We are unable to oblige from the "hoffice," so will anyone with copies for disposal please get in touch with him direct.

And finally, I hear of a few petrol engines and accessories available from the following:—

P. J. Dannhorn, 12, Avenue Road, Doncaster.
A. R. B. Nash, 'Redwayne,' Between Streets, Cobham.
P. Dawson, 'Greylands,' Victoria Road, West Hartlepool.
A. T. Sayers, 58, Stanley Avenue, Dagenham.

Anybody interested should get in touch with these chaps direct.

Well, that's the lot for another month, and I hope to hear more from now onwards of good flying and broken records in the outdoor fields. One gets a bit tired of typing R.T.P., and it will be a decided change to give the old H.L. and R.O.G. letters an airing. Till next month fellers—'Keep 'em Flying.'

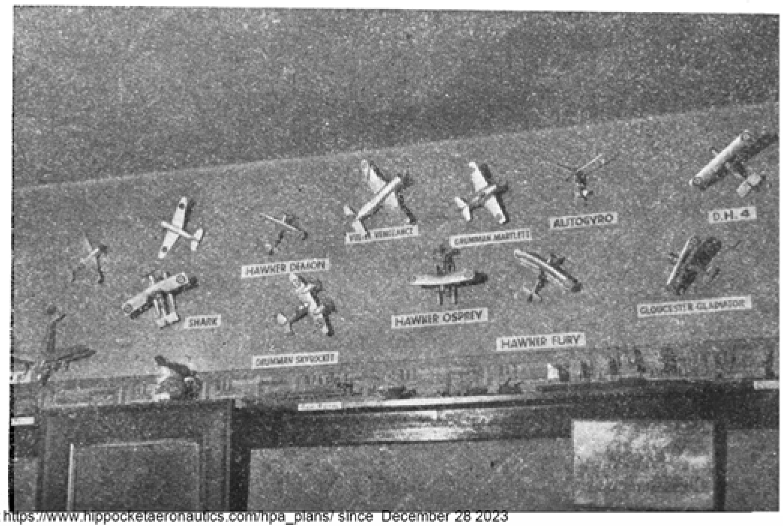
The CLUBMAN.

NEW CLUBS

CIRRUS M.F.C.
F. W. Sellers, 43, Dynever Road, Tunbridge Wells.
EXPERIMENTAL M.A.C.
D. R. Davidson, 5, Broadway, Shenfield, Essex.
TRURO & DISTRICT MODEL ENGINEERING & EXPERIMENTAL SOCIETY.
E. K. Winhall, 45, Tresawls Road, Highertown, Truro.
BRITISH AIRWAYS M.F.C.
H. A. Adam, The Cottage, Marksbury, Nr. Bristol.

SECRETARIAL CHANGE

SPELDHURST (Kent) M.A.C.
D. S. Saunders, 'Lodgefields,' Withyham, Nr. Tunbridge Wells.



Here's another cute stunt—Reader D. McNaughton of West Hartlepool thought up this novel method of frieze decoration, and jolly effective it looks. Note the line of ships on the plaque rail.

MARKET SUPREME SOLIDS

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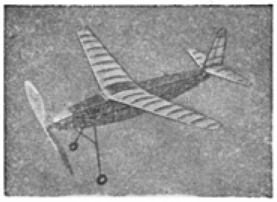

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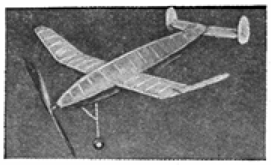

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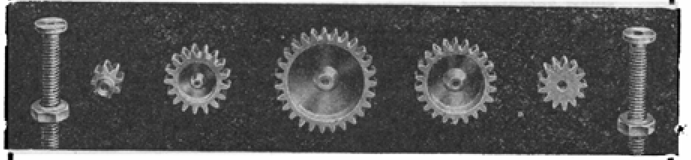

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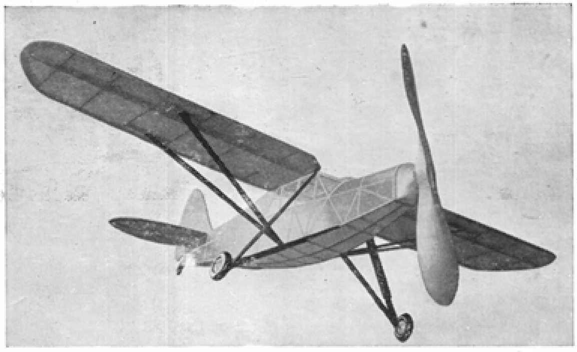

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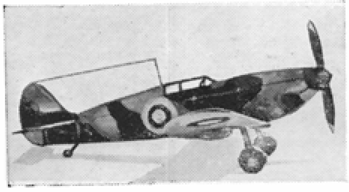

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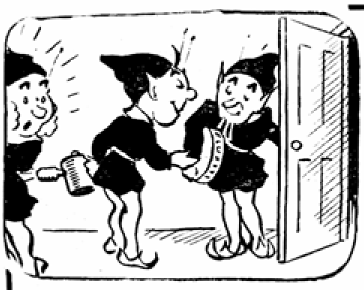

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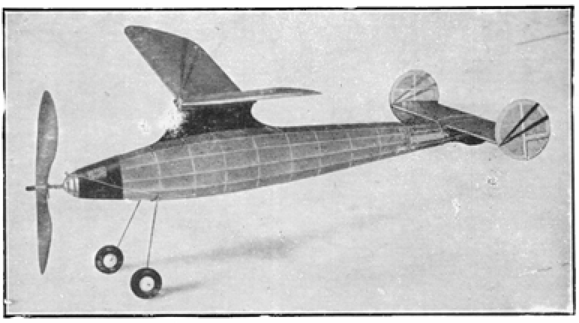

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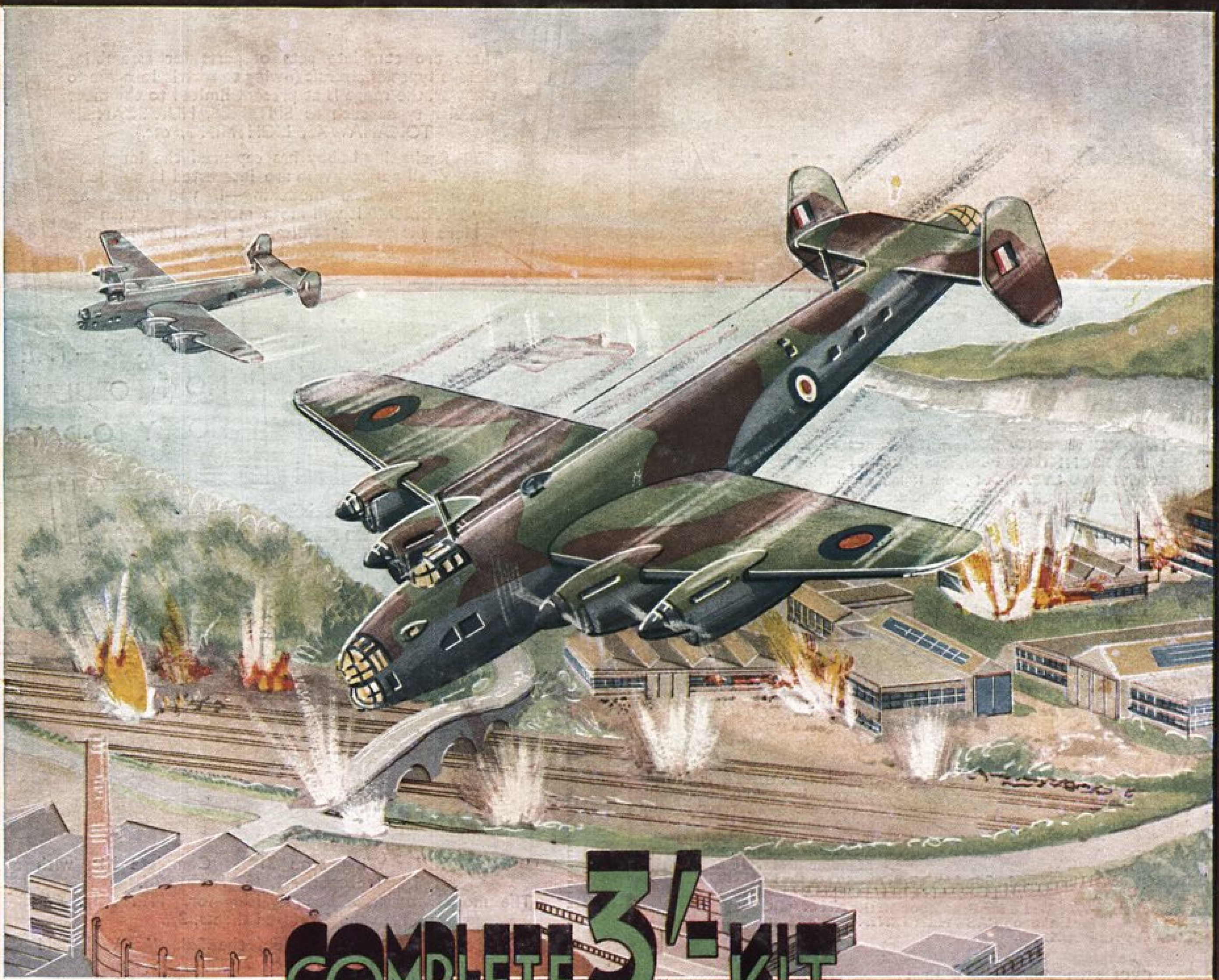

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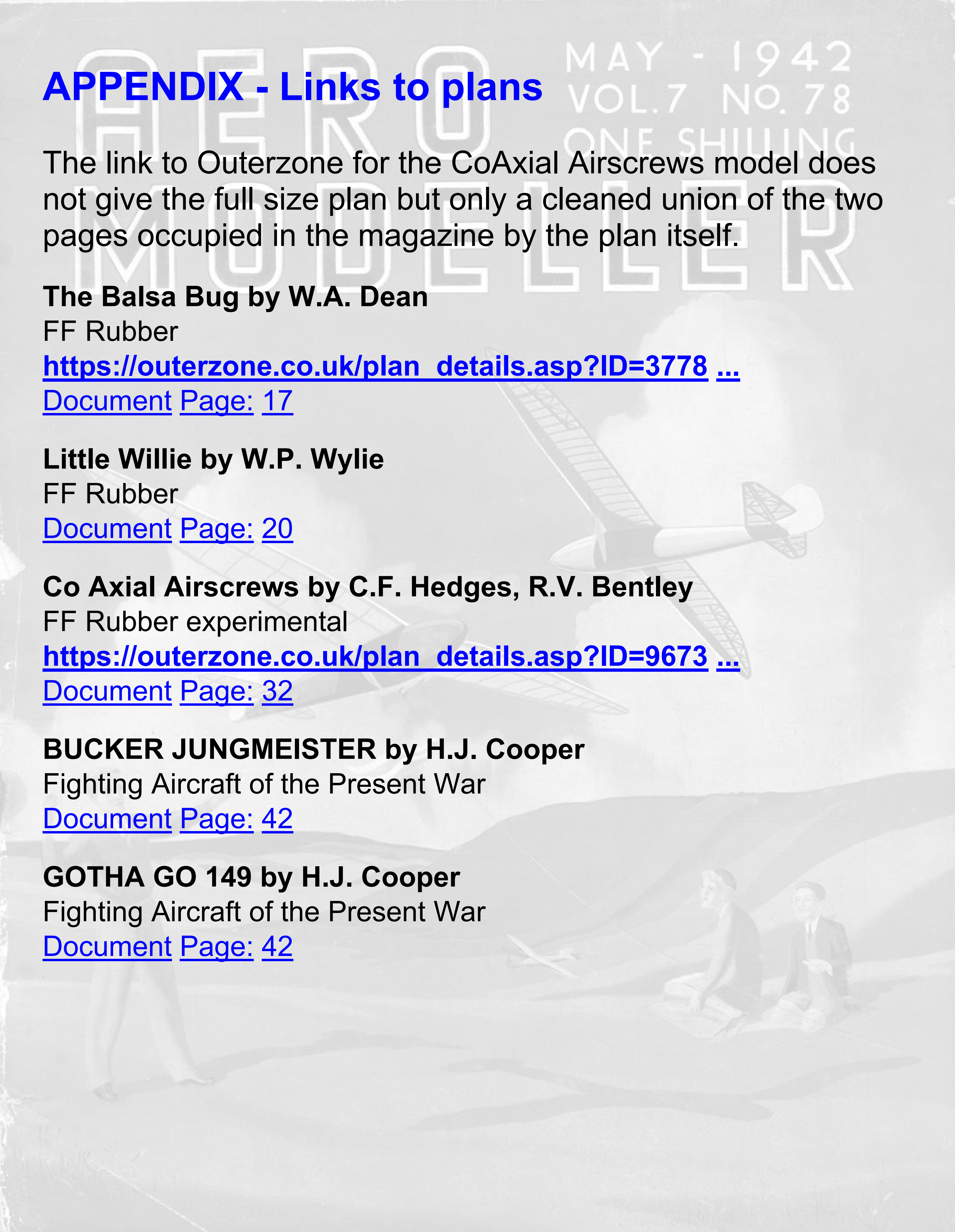

APPENDIX - Links to plans

The link to Outerzone for the CoAxial Airscrews model does not give the full size plan but only a cleaned union of the two pages occupied in the magazine by the plan itself.

The Balsa Bug by W.A. Dean
FF Rubber
https://outerzone.co.uk/plan_details.asp?ID=3778 ...
Document Page: 17

Little Willie by W.P. Wylie
FF Rubber
Document Page: 20

Co Axial Airscrews by C.F. Hedges, R.V. Bentley
FF Rubber experimental
https://outerzone.co.uk/plan_details.asp?ID=9673 ...
Document Page: 32

BUCKER JUNGMEISTER by H.J. Cooper
Fighting Aircraft of the Present War
Document Page: 42

GOTHA GO 149 by H.J. Cooper
Fighting Aircraft of the Present War
Document Page: 42